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A CONTINUING PLAN
FOR TRAFFIC OPERATIONS

TOPICS

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BILLINGS

PLAN FOR TRAFFIC OPERATION IMPROVEMENTS 1970-71

PREPARED BY THE

MONTANA DEPARTMENT OF HIGHWAYS
PLANNING RESEARCH BUREAU

IN COOPERATION WITH

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION



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F O R E W O R D

This study is intended to provide a base for selecting TOPICS improvements. It is a partial inventory of those features of the tentative TOPICS system that were readily available. It focuses on short-range improvements, maintaining mobility within the street network during periods the long range plans are being developed, financed and implemented. It is a complement to the long range planning process.

Many TOPICS improvements have been identified and it is intended that the analysis of the problems will permit the development of solutions for the problem areas. The listing of potential improvements does not represent a course of action; instead, it proposes solutions which merit consideration.

TABLE OF CONTENTS

Introduction.....	1	Area IV - Southwest Corridor.....	163
Areawide Plan.....	1	Central Avenue-Montana Avenue to 24th Street West.....	163
Study Approach.....	2	Moore Lane and U. S. 10.....	163
		Cost Summary.....	188
Study Area	2	Area V - Southern Corridors.....	189
Population	3	1st Avenue South and 27th Street.....	189
Land Use and Topography.....	3	State Avenue-1st Avenue South to South 27th Street.....	189
		Cost Summary.....	204
Study Area Analysis		Area VI - Northwest Corridor Billings Heights.....	205
Area I - CBD Circulation Plan.....	13	U.S. 87 - 312 - I-90 Business Route Intersection.....	205
Recommended Improvements.....	13	4th Avenue North-North 13th Street Intersection.....	205
East-West Traffic Flow.....	13	4th Avenue North - 6th Avenue North Couplet.....	206
North-South Traffic Flow.....	14	Cost Summary.....	224
Alternate Plans.....	15		
Cost Summary.....	74	Area VII - East Corridor Lockwood.....	225
Area II - Northwest Corridor.....	75	Federal Aid System Review.....	227
Poly Drive-Grandview Blvd. - North 30th St.....	75	Urban Area Cost Summary.....	229
Poly Drive-Grandview Blvd.-Virginia Lane.....	75	Adopted Circulation Plan.....	230
Cost Summary.....	118	Project Priority Listing.....	231
Area III - West Central Corridor.....	119		
Grand Avenue-Division to 24th Street West.....	119		
Broadwater Avenue-Division to 28th Street West.....	120		
Lewis Avenue-8th Street West Intersection.....	122		
Cost Summary.....	162		

LIST OF FIGURES

Figure	Page	Figure	Page
<u>URBAN AREA</u>		28. Intersection Improvement-Virginia Lane-Poly-Grandview.....	79
1. Study Approach	1	<u>AREA III</u>	
2. Population Trends	2	29. High Accident Locations.....	123
3. Study Areas.....	4	30. Street Improvement-Broadwater Widening.....	124
4. Tentative Topics System	5	31. Intersection Improvement-Lewis-8th Street West...	125
5. Functional Classification	6	<u>AREA IV</u>	
6. Major Physical Barriers.....	7	32. High Accident Locations.....	165
7. Land Use	8	33. Street Improvement-6th Street West-Central-Ramp..	166
8. Urban Traffic Flow Map	9	34. Intersection Improvement-Moore Lane-F.A. Route 2.	167
9. Traffic Signal Locations.....	10	<u>AREA V</u>	
10. Quality of Travel	11	35. High Accident Locations.....	191
11. Improvement Locations	12	<u>AREA VI</u>	
<u>AREA I</u>		36. High Accident Locations.....	207
12. Vol/Cap Status in CBD	16	37. Intersection Improvement-U.S. 87-312-I-90 Business Route.....	208
13. Quality of Travel in CBD.....	17	38. 4th Avenue North-6th Avenue North Couplet-Possible Cross Street Connections.....	209
14. High Accident Locations.....	18	<u>AREA VII</u>	
15. Traffic Flow Map.....	19	39. High Accident Locations.....	226
16. Parking Inventory - On Street.....	20	<u>SUMMARIES</u>	
17. Plan A - Circulation.....	21	40. Recommended Topics System.....	228
18. Plan B - Modified Circulation.....	22	41. Adopted Circulation Plan.....	230
19. Plan C - Circulation	23	42. Evaluation Form.....	232
20. Long Range Plan	24		
21. Truck Parking on Montana.....	25		
22. Proposed Signal System-Interconnect.....	26		
23. Traffic Distribution with North 30th Street.....	27		
24. Intersection Improvement-Grand-6th-Division-32nd...	28		
25. Intersection Improvement-Montana Avenue-Custer Avenue-Broadwater Avenue-1st Avenue North-Division Street.....	29		
<u>AREA II</u>			
26. High Accident Locations.....	77		
27. Intersection Improvement-30th-Grandview-Poly.....	78		

BILLINGS TOPICS

Chapter I

Introduction

The TOPICS program is described as an "urban traffic operations program to increase capacity and safety". It is designed to be a continuing program within designated boundaries of urban areas for the purpose of reducing traffic congestion and facilitating the flow of traffic. Improvements are to be made on a systematic basis in accordance with an areawide plan over a network of arterial and other major streets in the urban area.

The TOPICS program is intended to "maximize the efficiency of the existing street system" without major construction or reconstruction.

Areawide Plan

The areawide TOPICS plan contained herein is a review of the existing street network operations, its deficiencies, and recommendations for improvement within the scope of the TOPICS concept. Most recommendations involve the use of traffic control devices including a limited amount of channelization or physical change in street sections.

In order to expedite the analysis of an area of the size of Billings, it appeared desirable to break up the entire urban section into several homogenous subsections using a corridor approach as the basis for each subsection. Figure 3 shows the seven areas selected.

Figure 4 indicates the tentative Type II system set up for study purposes. The system is based upon the recently completed update of the Urban Transportation Plan and should not change to any great extent with the completion of this study. All Federal Aid Primary, Urban and Secondary systems within the study area are being reviewed for possible revision of the systems as the relationship changes with the creation of the Type II

STUDY APPROACH

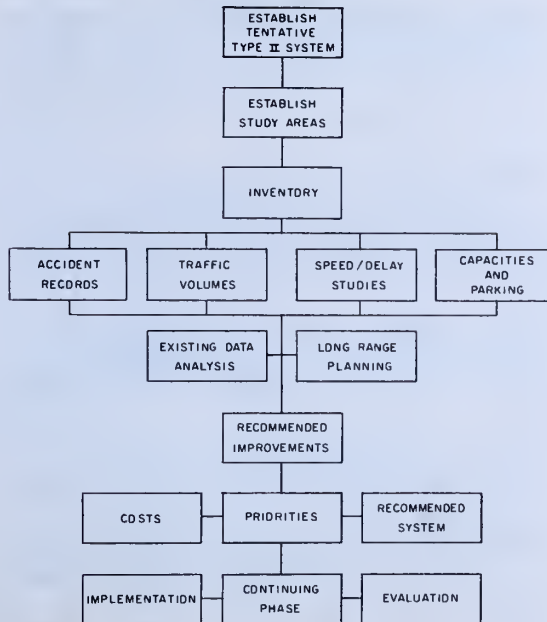
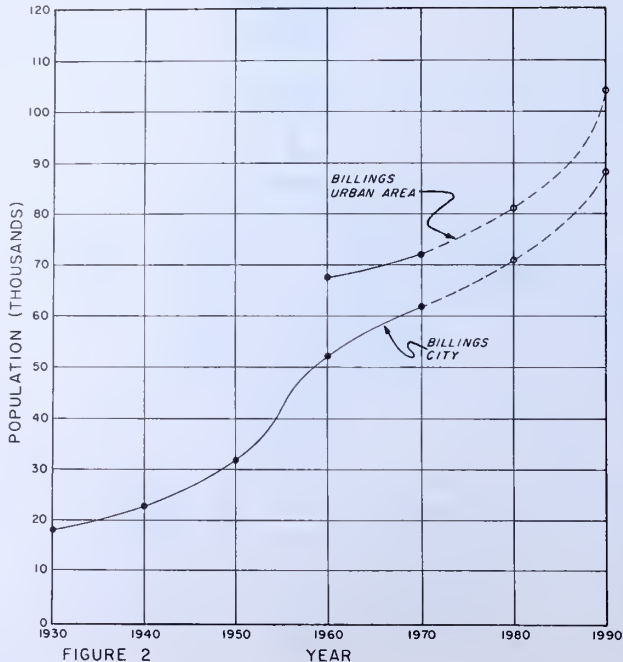


FIGURE I

POPULATION TRENDS
1930 - 1970
1990 PROJECTED



network. The street classification as established by the 1968 Functional Classification Study has also been incorporated into the TOPICS analysis. Figure 5 shows the classified system.

Study Approach

With a tentative Type II system established and the study area sectioned into analysis areas of more convenient size, it was possible to concentrate on the more detailed aspects of the study.

The first step was the compilation of basic traffic data and a study of existing problem areas. This included the collection of new and existing volume counts, speed and delay studies, accident data, parking usage, and a physical inventory of the tentative Type II system.

The second stage of the study involved the analysis of data collected. Where the number of accidents appeared relatively high, or in those areas where speed and delay studies indicated unnecessary delays in traffic flow, an attempt was made to determine the cause. Problem locations were studied to determine improvement possibilities.

The third or continuing phase of the study will include an update of the inventory data. It is possible that this phase could be included as a part of the continuing planning process. The update should incorporate new or different trends that are evident in the various corridors and also make the necessary evaluation of improvements.

Evaluation

During the continuing phase certain completed TOPICS Projects will be selected for evaluation. Procedures for selection have not been detailed however, it is assumed that this will be accomplished on significant segments of the several study areas.

The common method of evaluation is the standard "before versus after" study which compares changes in travel time, delay and accident frequency. Some projects which relieve a localized

problem, such as a new signal at a previously congested intersection, can be evaluated in this manner, the problem associated with a project of considerable area-wide scope can only be evaluated by introducing additional terms such as diverted volume, changes in accident rates and annual road user savings. Figure 42, page 232, is a suggested format for presenting evaluation data.

Technical Capabilities

The City of Billings is capable of developing a continuing traffic operations program. The Engineering Department is composed of a City Engineer, an Assistant City Engineer and a Traffic Engineer and is supported by a complement of engineering technicians for both field and office work.

A Traffic Superintendent directs the Traffic Department which includes an electrician, a painter, a foreman and four laborers. They are in charge of the operation, maintenance and repair of signing, traffic markings and signals on the local street system and have established a periodic maintenance program.

It appears that the city is adequately staffed to ensure proper maintenance of existing and future traffic signal installations.

Laws and Ordinances

The "City of Billings Traffic Code", Chapter 21 of the Billings City Code, specifies vehicle standards, rules of the road and standards for traffic signing, traffic markings and signalization. It applies to all types of traffic including emergency vehicles, school buses, trucks, cycles and pedestrians and also specifies the duties and authority of the police department and city traffic engineer.

This code is not in full conformance with national standards and has not been updated to the 1971 "Manual on Uniform Traffic Control Devices."

The Ordinance No. 2677 of the Billings City Code applies to the "City Zoning Districts"; the Ordinance No. 3462 specifies the curb cut regulations; the Ordinance No. 3439 requires a minimum set-back for buildings along arterial streets.

Generally, the existing codes and ordinances are quite comprehensive and are useful tools for administrative and enforcement functions. It is recommended, however, that the necessary revisions be made to bring them into conformance with the 1971 "Manual on Uniform Traffic Control Devices".

II

Study Area

Billings is the largest city in the State of Montana with a 1970 urban population of 71,197 persons. Located in south central Montana, it is a relatively isolated urban area and due to its location has become a midway or terminal point between the Pacific coast and the manufacturing centers of the midwest. The city functions as a wholesale storage and distribution center for a wide geographical area.

Major highways serving the area are Interstate Routes 90 and 94 and U. S. Routes 10, 87, 212 and 312. State Route 3 also serves Billings from the north and is a principal arterial connecting Billings and Great Falls which is the only other urban area over 50,000 population in the State at the present time.

Population

The growth rate of Billings has exceeded that of the State as a whole. Reasons for the growth can be attributed to its position as a regional center, petroleum and agriculture.

As noted above, the 1970 population was found to be 71,197 persons. The projected population for 1990, as supplied by the Billings City-County Planning Board is 104,000 persons. Figure 2 shows the past and projected growth trends of the area.

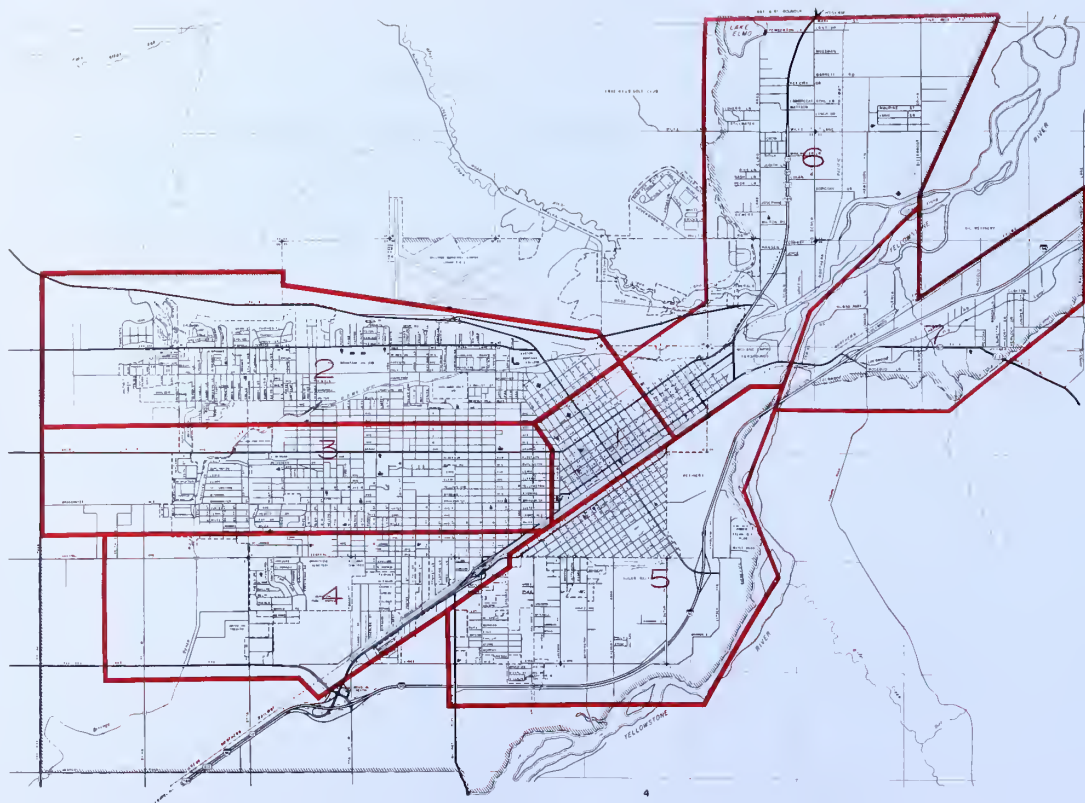
Land Use and Topography

The basic pattern of the Billings street system has been strongly influenced by the Burlington Northern Railroad, Yellowstone River and the rimrocks, as shown in Figure 6. The initial streets system was oriented to the railroad which traversed the area in a northeast, southwest direction. Later street developments were laid out on the governmental land net and run in a north-south, east-west direction.

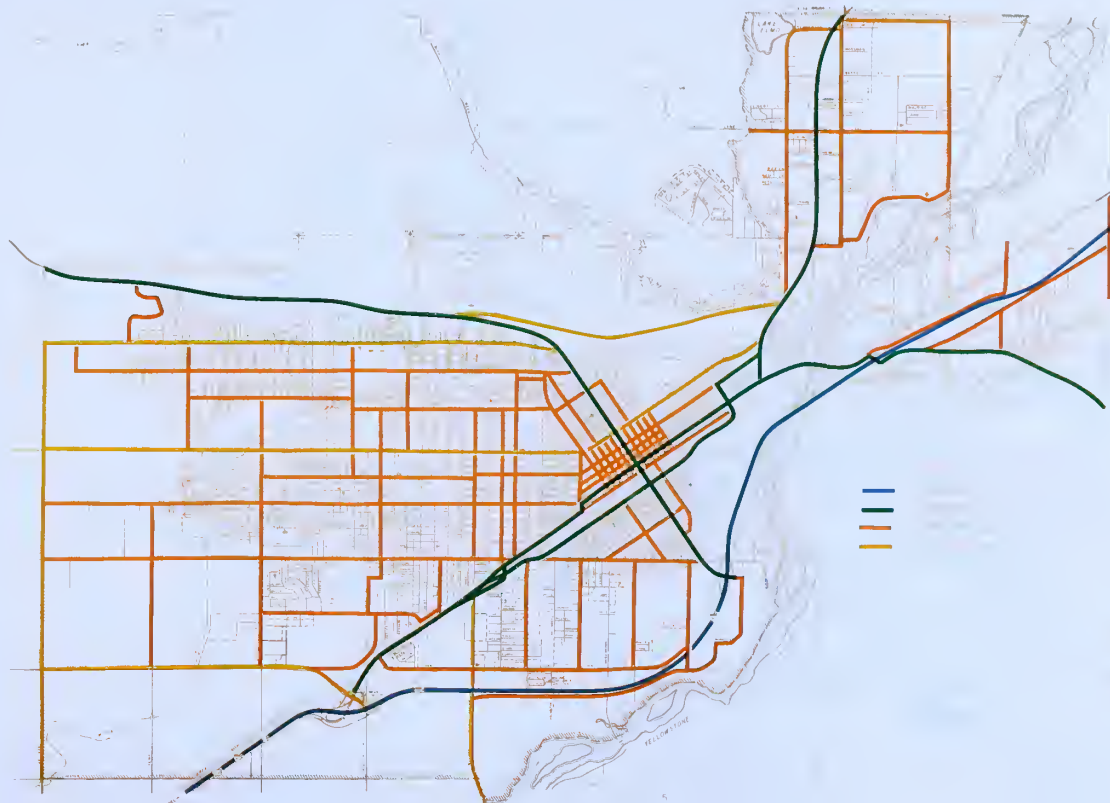
Major development to the east was influenced by the convergence of the river, railroad and rimrocks which created a narrow passage to the east while the western section was open, flat and easily developed. Areas have since developed to the east, such

as Billings Heights and Lockwood, but access to these areas is still strongly influenced by the topographic features.

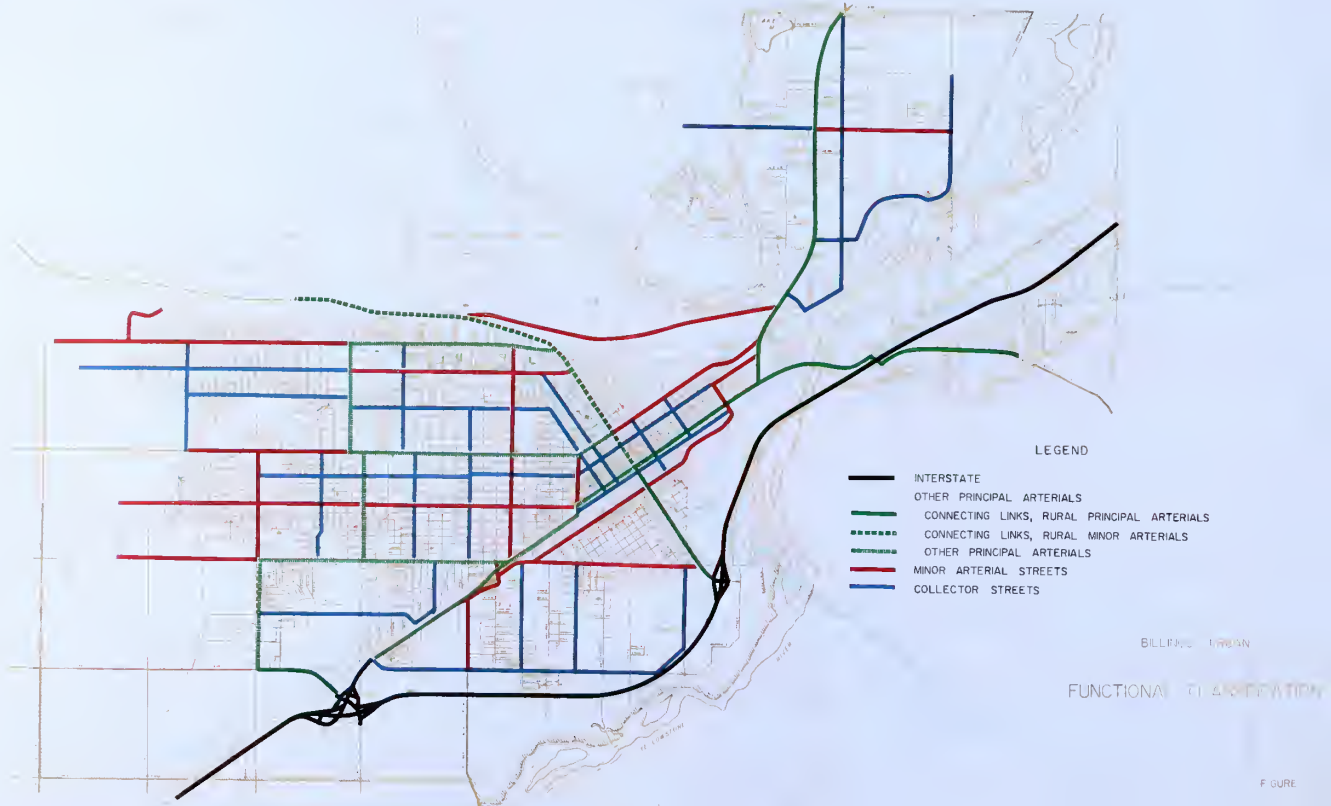
General land use patterns are shown in Figure 7. Land use is typical for a community initially established along a railroad. Business-commercial uses are concentrated along the railroad right of way with the CBD lying just north of the main line. Since the railroad does bisect the area, it acts effectively as a major barrier with a limited number of crossings. The western section is largely residential with strip development becoming more evident as the center of population shifts in this direction. Access to and from the CBD from the western residential section has become a problem.



BILLINGS URBAN
STUDY AREAS



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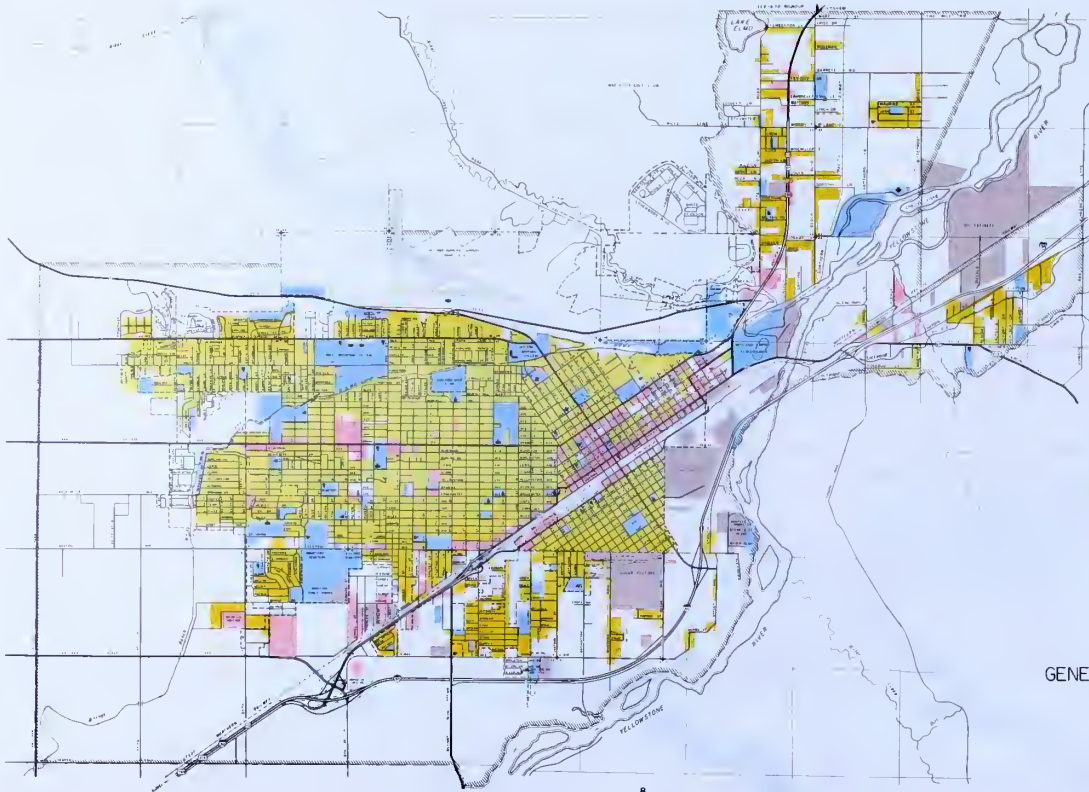




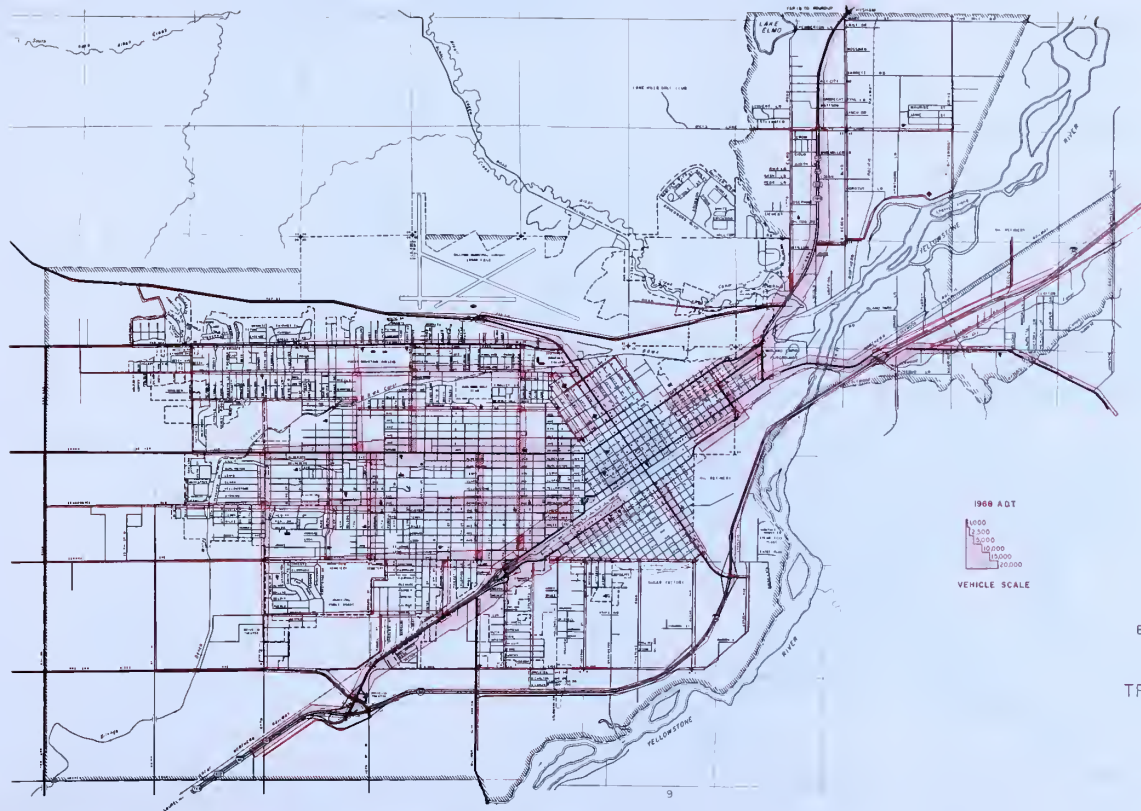
LEGEND

- INTERSTATE
- BRIDGE
- RAILROAD
- RIMROCKS
- B B W A CANAL

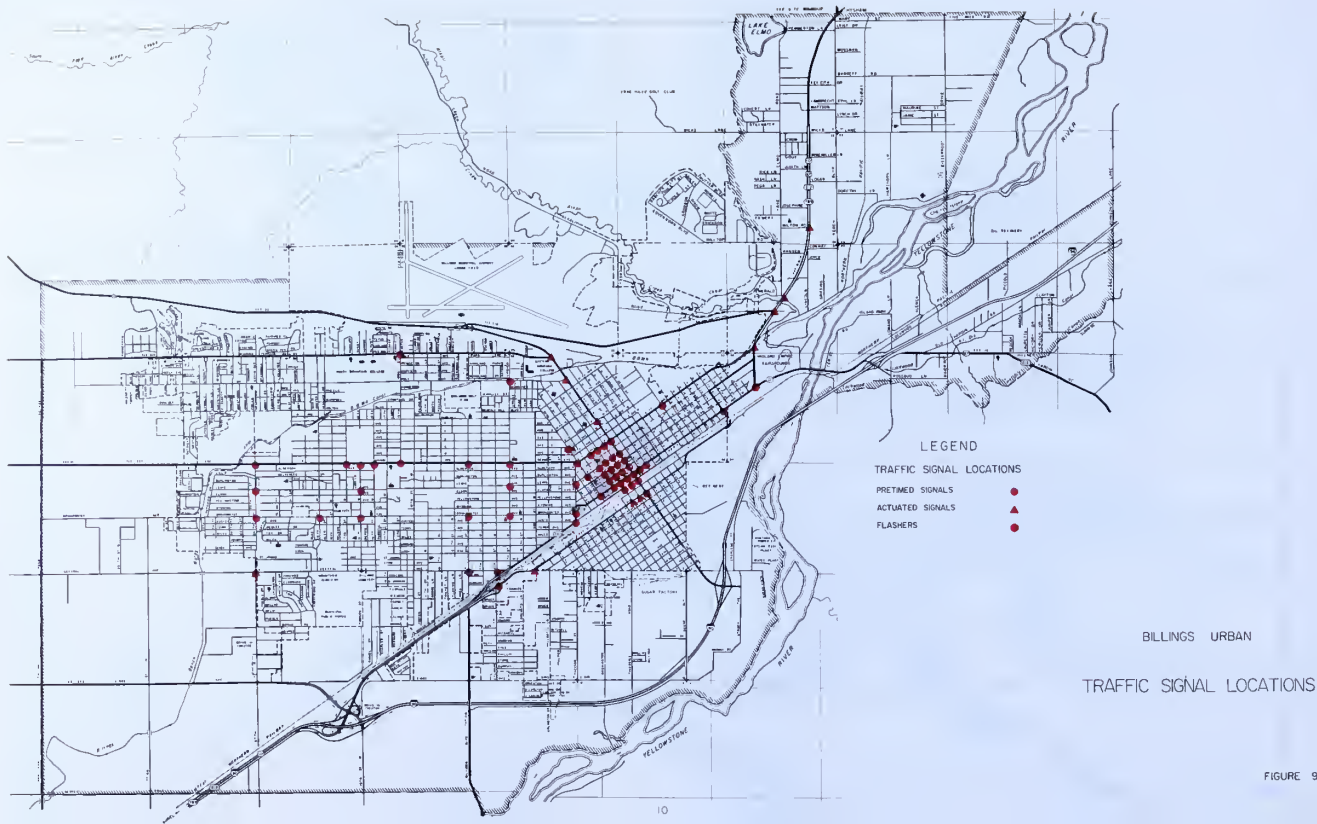
MAIN PHYSICAL BARRIER



BILLINGS URBAN
PRESENT
GENERAL LAND USE MAP



BILLINGS URBAN
1968
TRAFFIC FLOW
MAP



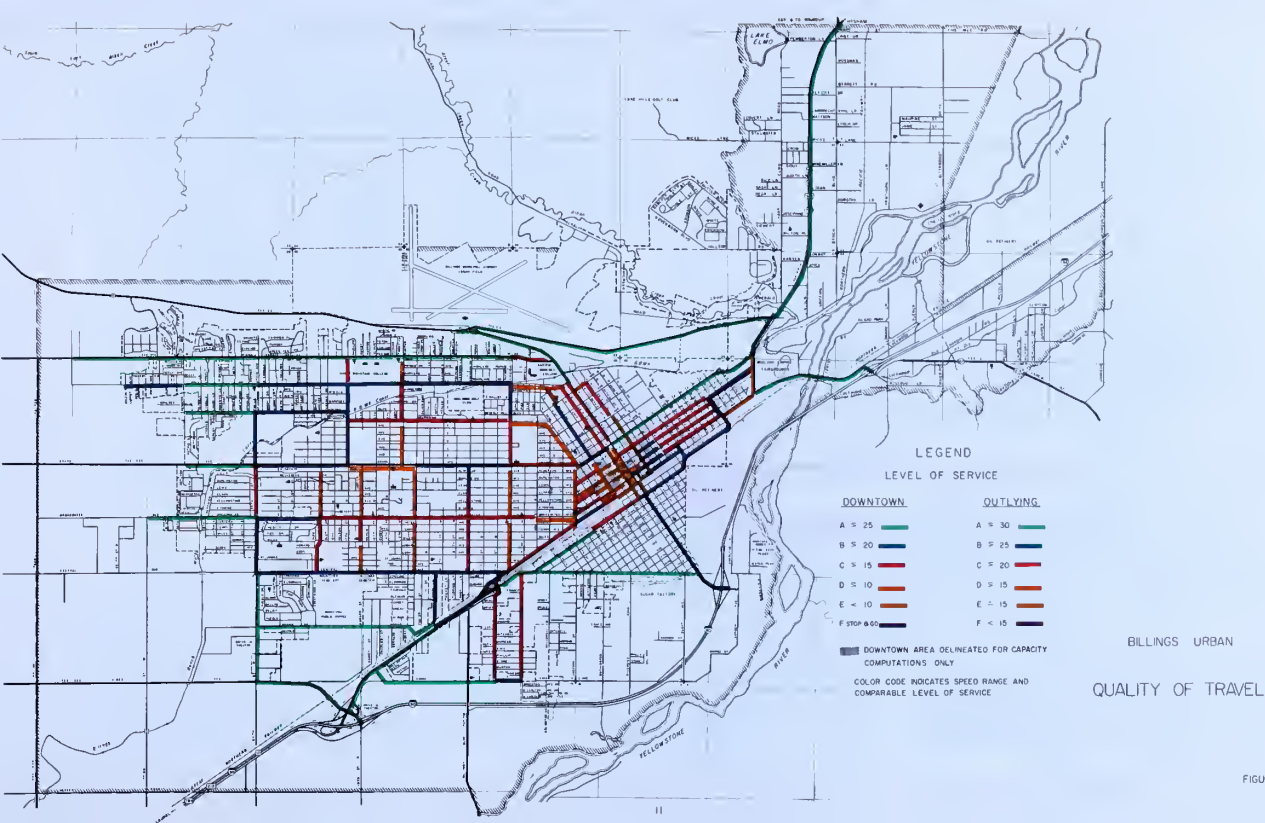
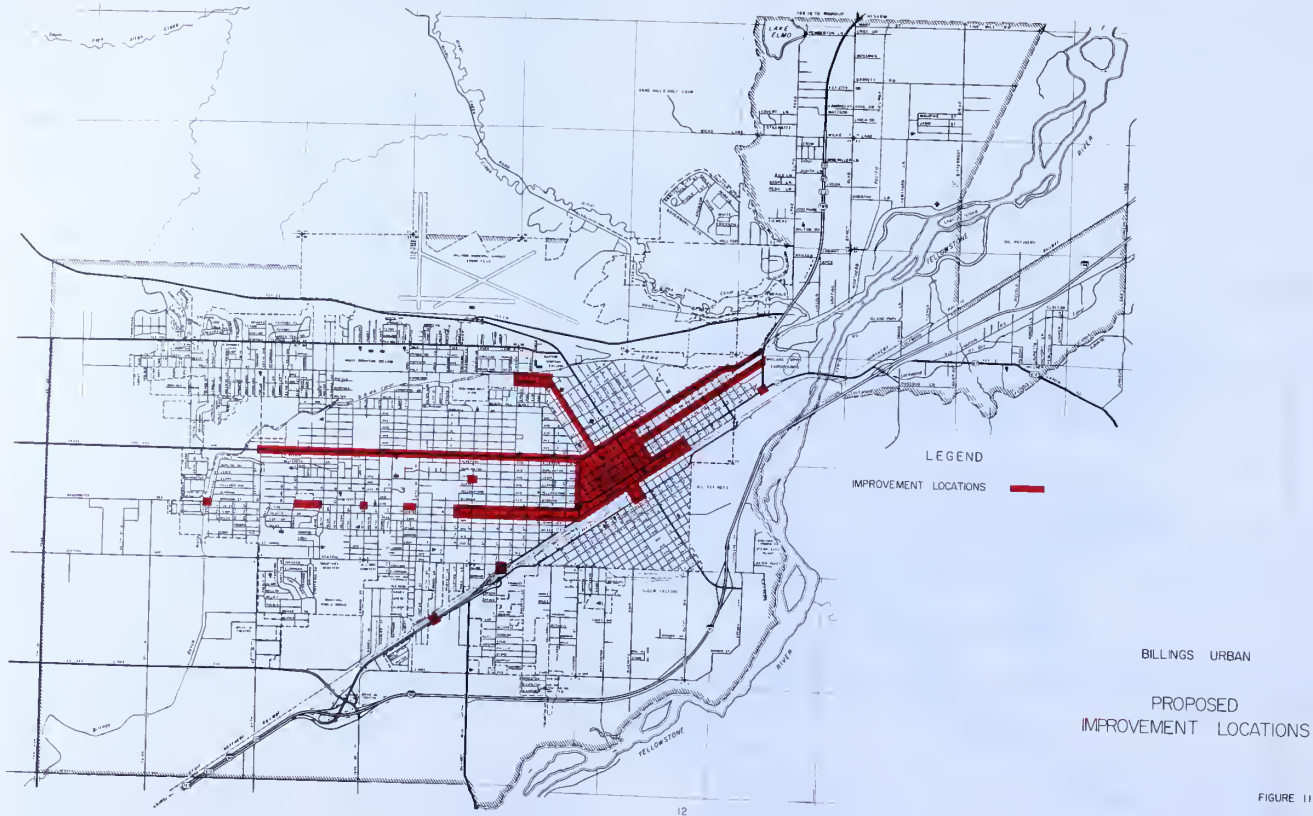


FIGURE 10



AREA I - CBD Circulation Plan

Problem - Area I encompasses the CBD and fringe areas. As with most downtown areas, traffic volumes are relatively high and due to the fact that both a major north-south and east-west arterial intersect in the CBD, some of the intersections are operating at or above traffic capacity and causing excessive delays. Pages 30 thru 73 show the existing conditions on major streets and the present level of service on both north-south and east-west streets through the area.

With the exception of signals recently installed under an F9999 project on the Primary System, most signal installations are below uniform manual standards and consequently, unable to provide the efficient metering of traffic required during both peak and off-peak periods.

Capacity - Figures 12 and 13 indicate the intersections with the greatest capacity problems. Most intersections in the core area are operating at 80 to 100 percent of capacity with several street sections dropping to a level of service F during peak hours.

Accidents - Figure 14 indicates that 32 intersections in the area are experiencing at least five accidents a year with six exceeding fifteen accidents per year. Pages 30 through 73 also indicate the type of accidents that have occurred. Most of the established patterns are subject to correction with improved signalization, signing, or changes in operational movements.

Recommended Improvements

General - It has been generally conceded in most major cities that a one-way grid system in the CBD and fringe areas is the least expensive method of providing improved traffic flow and at the same time retaining on-street parking. Capacity can be increased due to the reduction in turning movements and there exists the possibility that near perfect progression can be obtained for signalized systems. Safety is provided by the elimination of opposing traffic. Better vehicular and speed control results in more opportunities for vehicles and pedestrians to

cross or enter from side streets and the smoothness and orderliness of operation reduces driver impatience and accident prone behavior.

Due to the general uniformity of the CBD grid system and the location of major arterials feeding into the grid, it appears feasible to suggest an extensive one-way system in this area as shown in Figure 19, Plan C.

East-West Traffic Flow

4th-6th Avenue North Couplet - It is proposed to provide a one-way flow of traffic from the intersection of Grand, Division and North 32nd Street, easterly on 4th Avenue North and westerly on 6th Avenue North to the intersection of both streets with Exposition Drive (U. S. 312-87). The need for an increase in capacity and operating speed on both streets is apparent between the intersections of North 32nd Street and North 27th Street where present peak hour speeds are 10-12 mph. The two highest accident locations are also located on 6th Avenue North at North 27th Street and North 30th Street as indicated by Figure 14.

Fourth Avenue North also has a relatively high number of accidents at all intersections between North 26th Street and North 30th Street.

It is intended that the couplet be completed in two stages. The first stage would start at the intersection of Grand-Division and North 32nd Street on 6th Avenue North and continue easterly to North 20th Street. The 4th Street North portion would begin at North 32nd Street and also continue to North 20th Street. The second stage is dependent upon the upgrading of 4th Avenue North from the vicinity of North 15th Street easterly to Exposition Drive and would require major reconstruction.

The first stage of this couplet was implemented in June 1970 as a recommendation of both the 1968 urban transportation plan update and the TOPICS study, the analysis of Area I being essentially complete at that time. Prior to this conversion, 6th Avenue North had carried the bulk of the traffic and as indicated by Figure

12 and 13 was deficient in capacity and operating speeds. Although speed and accident studies have not been made since this conversion, it is apparent through observation that the signals along both streets need modernization. Full potential of the streets is not being utilized due to poor signal head location and the lack of interconnects to provide the necessary progression.

2nd-3rd Avenue North Couplet - The basis for inclusion of these streets as a part of a one-way system is to complete the east-west grid system in the downtown area.

The couplet would begin at Division Street on the west and continue easterly to North 20th Street. A future consideration would be to extend the couplet to Exposition Drive. This would require a short length of construction on 2nd Avenue North between North 9th Street and Exposition Drive where no street presently exists.

1st Avenue North - Montana Avenue Couplet - This is a recommendation from the Urban Transportation Study to provide more crosstown capacity for this Federal Aid Primary route. Introduction of the couplet at Division Street presents no particular problem and it could tie in with a recommended Broadwater-Custer Avenue couplet to serve the west side. The eastern terminal is presently planned for North 20th Street because traffic volumes drop off east of this point and roadway conditions on Montana Avenue appear to be unfavorable for heavy traffic loadings.

The one block of North 20th Street between Montana Avenue and 1st Avenue North was initially planned for the eastern transition for the one-way couplet. It is possible, however, that North 19th Street may make a better street to accomplish the transition due to the better geometrics of the street and the surfacing also appears to be more capable of handling additional traffic loadings. A more detailed study of the most desirable location is recommended during final design stages of the implementation of the couplet.

Of particular concern in the operation of this couplet are the Burlington Northern truck loading docks located west of North

29th Street on Montana Avenue. The semi-trailers that are parked for loading and unloading purposes do not normally encroach on the traveled way, but during backing and parking maneuvers traffic lanes are affected and at infrequent intervals all lanes may be blocked. Also along Montana Avenue, the 90 degree angle parking in the vicinity of North 23rd Street constitutes an encroachment on the traffic lanes during parking and unparking maneuvers. Vehicles parked at the 90 degree angle use about 10 feet of the 50 feet of curb to curb width.

The 90 degree angle parking should be eliminated by substituting parallel parking with a loss of a few parking spaces. The partial blocking of Montana Avenue during the parking of the large truck units at the freight terminal is a difficult situation. It is possible that a traffic control could be placed to restrict the parking maneuvers during peak hours or that the angle of parking could be reduced to lessen the encroachment on the traffic lanes. Figure 21 presents one possible solution, however, we recommend a separate study of this particular situation since it involves negotiation with the Burlington Northern Railroad Company.

North-South Traffic Flow

North 27th Street - Traffic between 1st Avenue South and 6th Avenue North on North 27th Street is experiencing an undesirable amount of congestion and delay due to high vehicular volumes and the railroad crossing between Montana and Minnesota Avenues. To alleviate this problem and preserve the continuity of travel between the I-90-South 27th Street Interchange and the airport, it is recommended that North 27th Street remain as a two-way facility flanked by couplet systems on North 25th-26th Streets and North 28th-29th Streets.

With the new signal system recently installed under the F9999 project, the capacity and the average overall speed of North 27th Street traffic will be improved during peak hours from its present level of service D/E. However, the greatest improvement to the most critical section between 1st Avenue North and 6th Avenue North will be the removing of parking to allow for four lane operation. This one measure alone will increase the capacity approxi-

mately 30 percent. Approximately 60 parking spaces would be removed of which two-thirds are metered for one hour or more and the remainder either short term or loading zones.

An alternate to the above recommendation would be to establish tow-away zones during the peak hours and retain the parking and loading zones during the remaining hours of the day.

Improvements to the street section between 1st Avenue North and 1st Avenue South would also increase capacity and reduce the accident potential at the railroad crossing. It is recommended that a minimum 52 foot section, capable of carrying four lanes of traffic, be constructed through this three block bottleneck.

North 28th-29th Street Couplet - In addition to providing better traffic circulation through the core area of the CBD, this particular couplet will help the 27th Street situation by providing additional storage for traffic backed up at the railroad crossing and also provide more convenient access to the CBD from either 1st Avenue South or 6th Avenue North. The couplet will also act as a backup system during peak hours.

North 30th Street - To retain North 30th Street as a two way facility beginning at Montana Avenue and extending north to the proposed Grandview-Poly Drive couplet would relieve North 27th Street of some of the Poly Drive traffic. Improvements on North 30th Street would include better signal timing at the 4th-6th Avenue North couplet, improved lighting and improvements at the intersections with both Grandview Boulevard and Poly Drive. Figure 23 indicates the probable distribution of traffic with

these improvements.

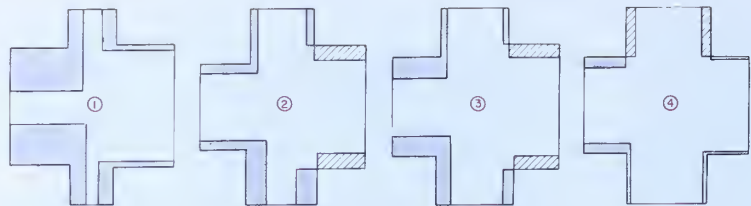
North 31st-32nd Street Couplet - These streets are included as one way couplets to complete the system serving the CBD. Including North 32nd Street as the southbound leg can, if necessary, provide additional capacity to the complex intersection of Grand Avenue, Division Street, 6th Avenue North and North 32nd Street. Figure 24 shows the recommended improvements.

*Alternate Plans - During the course of the study several alternate plans were proposed for the downtown circulation of traffic. Alternates A, B modified and C shown by Figures 17, 18 and 19 were studied but none were officially adopted by the local governments.

A long range plan has also been prepared as shown by Figure 20. This concept provides for a system of one-way streets that is controlled by the proposed mall area and the grade separations on North 25th Street and North 30th Street. Initial phasing of this plan would terminate the North 25th-30th Streets couplet at Montana Avenue utilizing North 27th and North 28th as a grade crossing couplet.

Should the long range plan be adopted in the future, there appears to be no major problems in converting anyone of the alternates shown. Plan C, however, will provide the least amount of disruption to established traffic patterns.

*. The street circulation plan recently adopted by the city council is shown on Figure 41, Page 230.

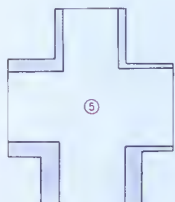


1ST AVE N & N 32ND ST

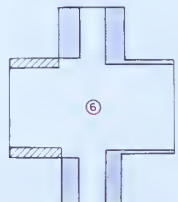
1ST AVE N & N 30TH ST

1ST AVE N & N 29TH ST

1ST AVE N & N 28TH ST



1ST AVE N & N 27TH ST



1ST AVE N & N 26TH ST



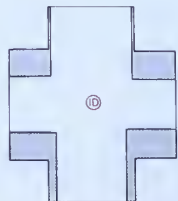
1ST AVE N & N 25TH ST



MONT. AVE & N 27TH ST



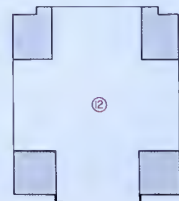
2ND AVE N & N 27TH ST



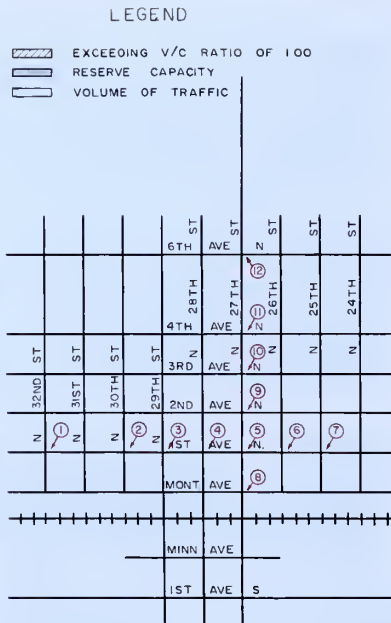
3RD AVE N & N 27TH ST



4TH AVE N & N 27TH ST



6TH AVE N & N 27TH ST



AREA I

EXISTING VOLUME/CAPACITY

Relationship in the CBD

FIGURE 12

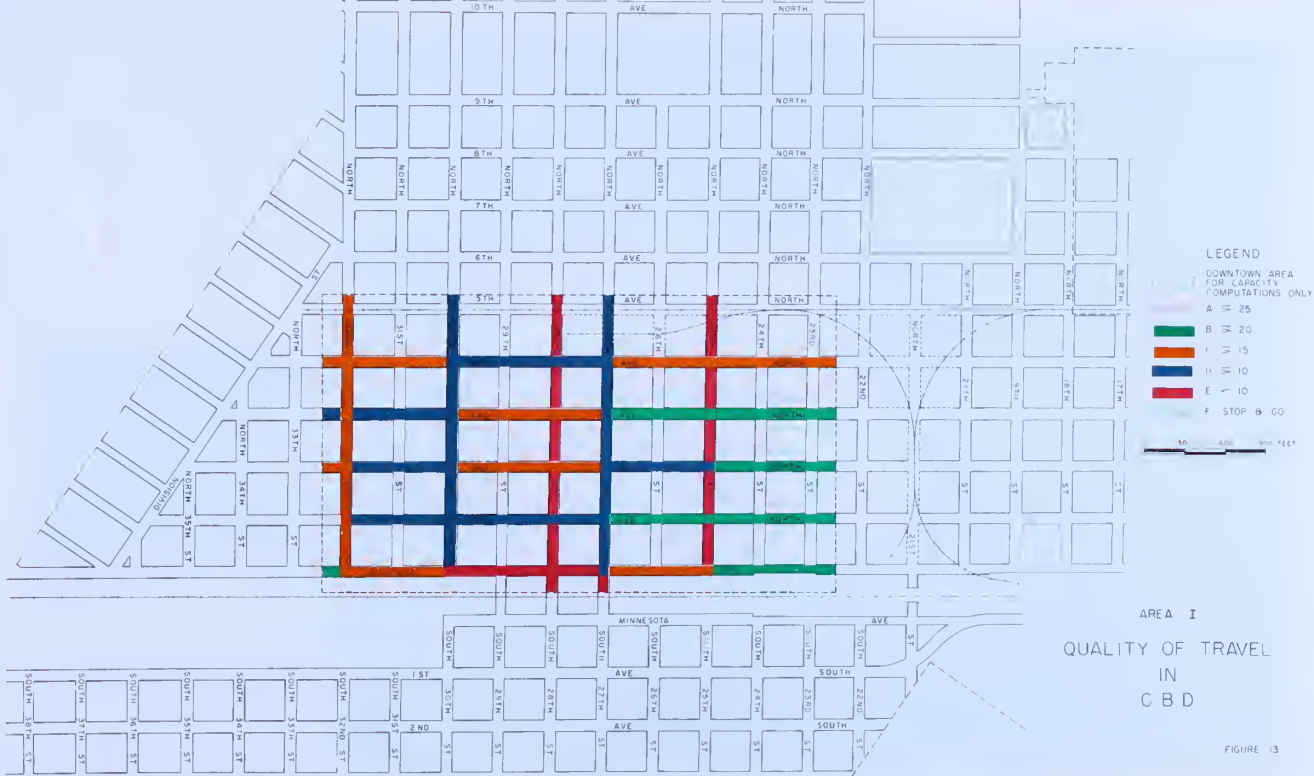
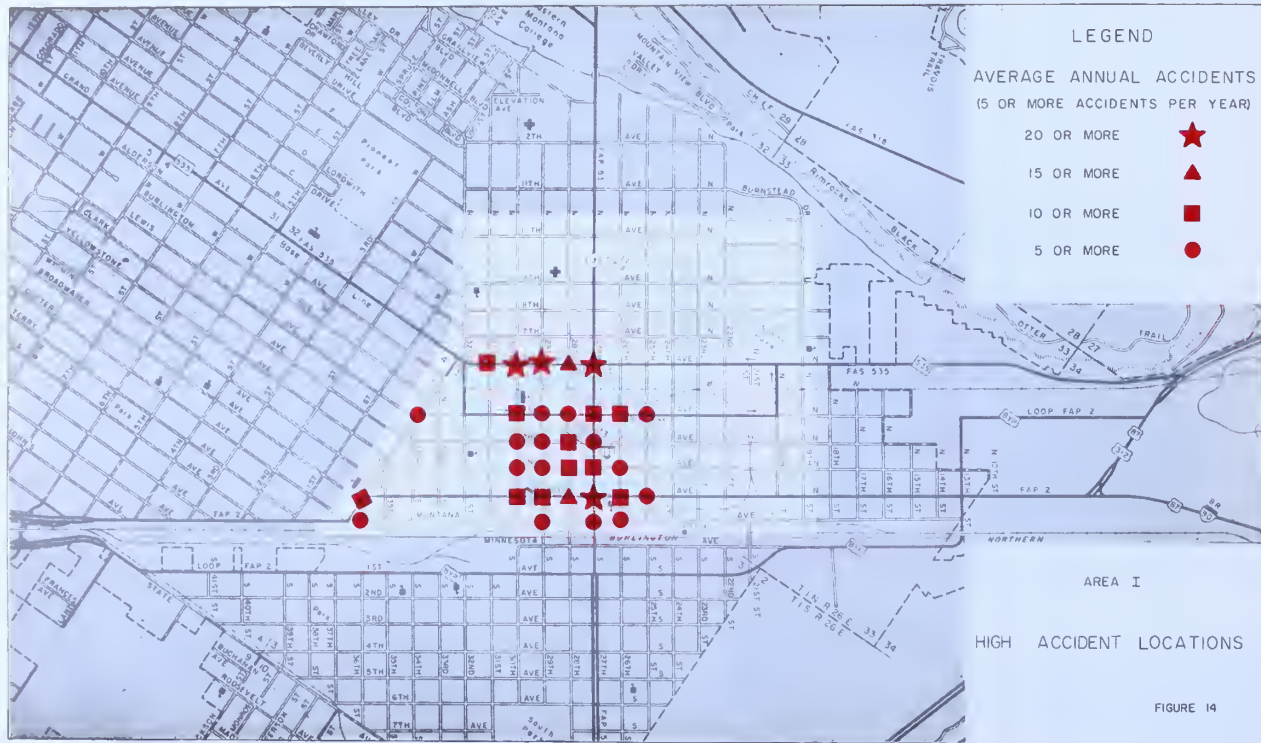
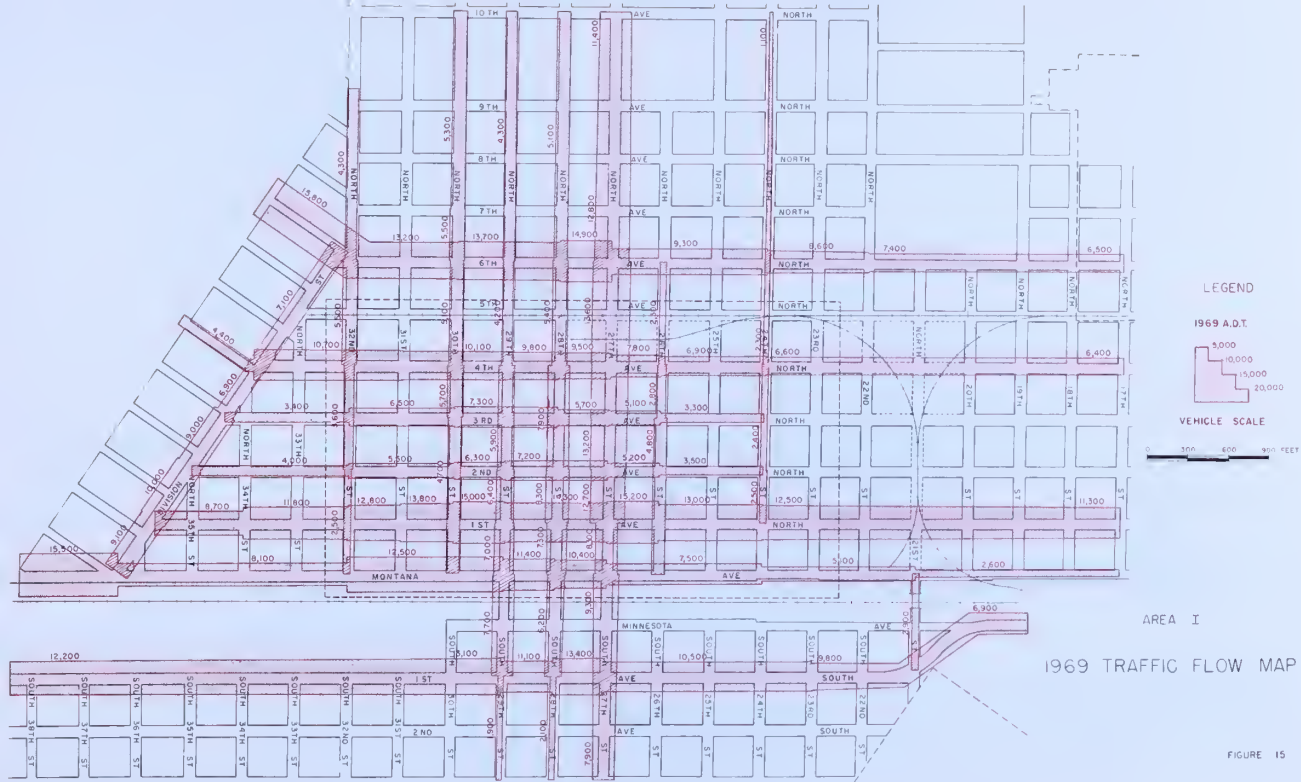


FIGURE 13





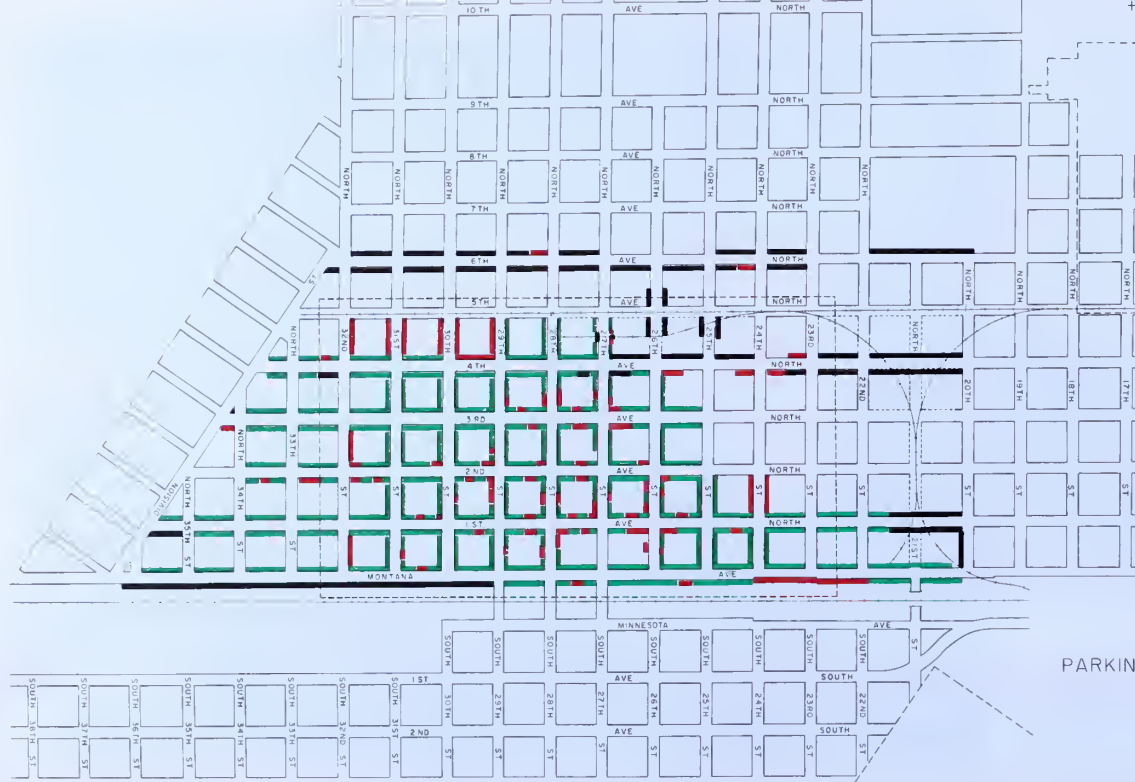
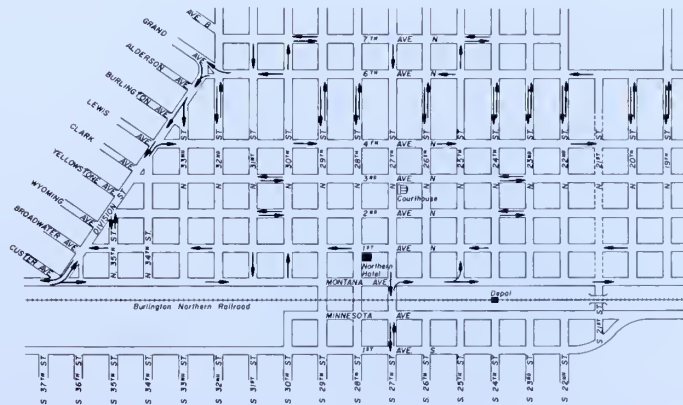


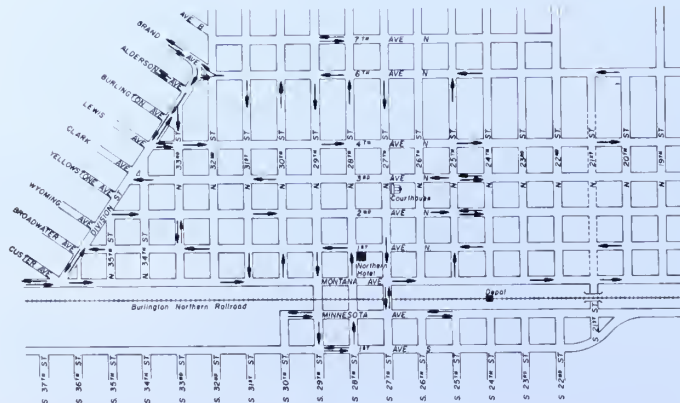
FIGURE 16



AREA I

PLAN A - CIRCULATION

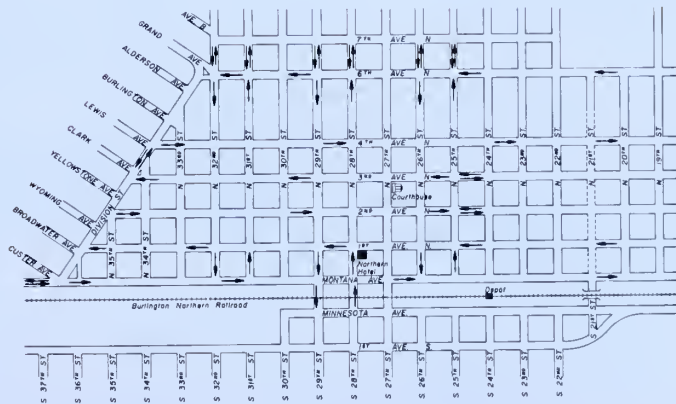
FIGURE 17



AREA I

PLAN B MODIFIED-CIRCULATION

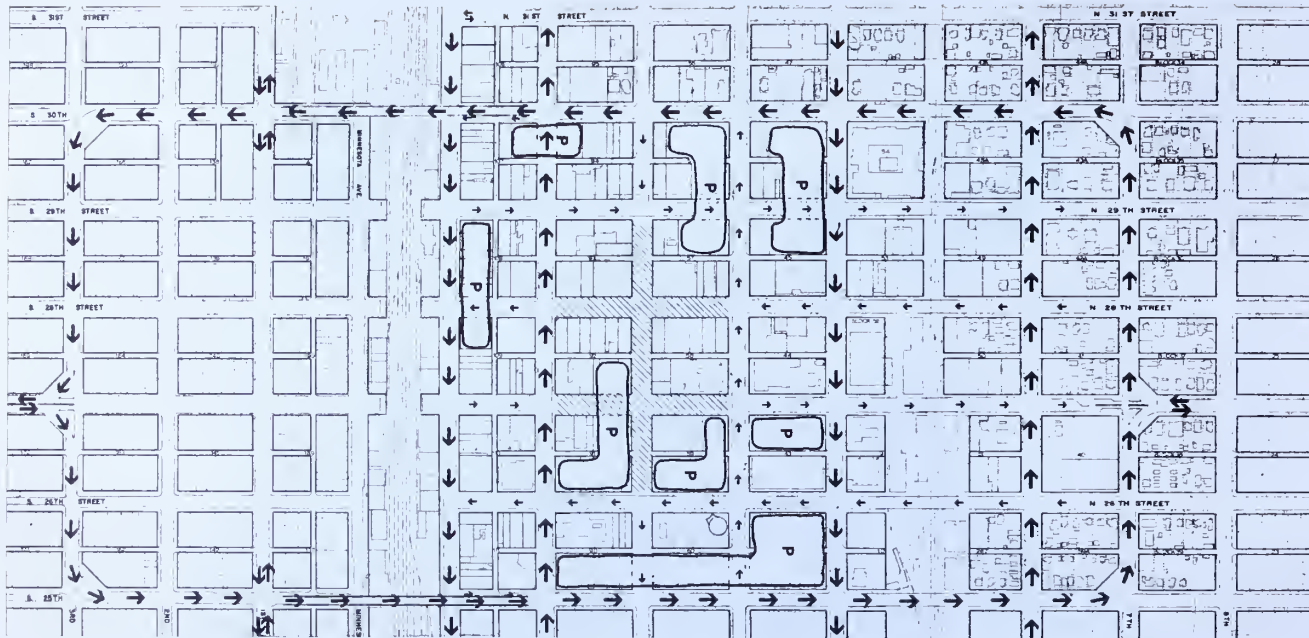
FIGURE 18



AREA I

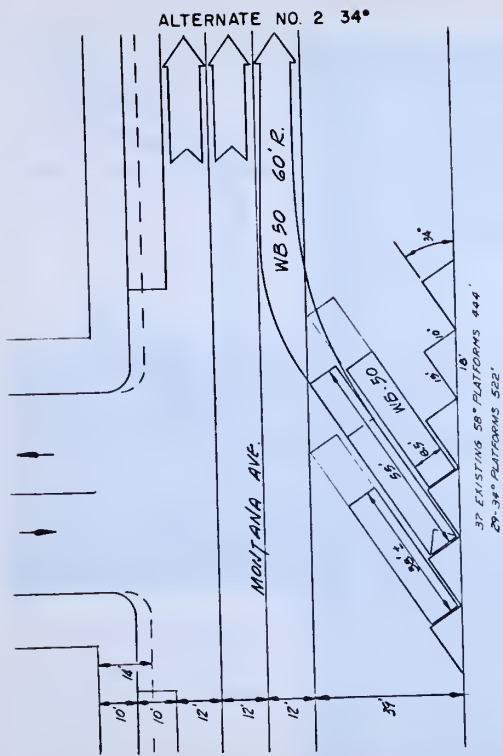
PLAN C - CIRCULATION

FIGURE 19



AREA I
LONG RANGE PLAN
(GRUEN)

FIGURE 20

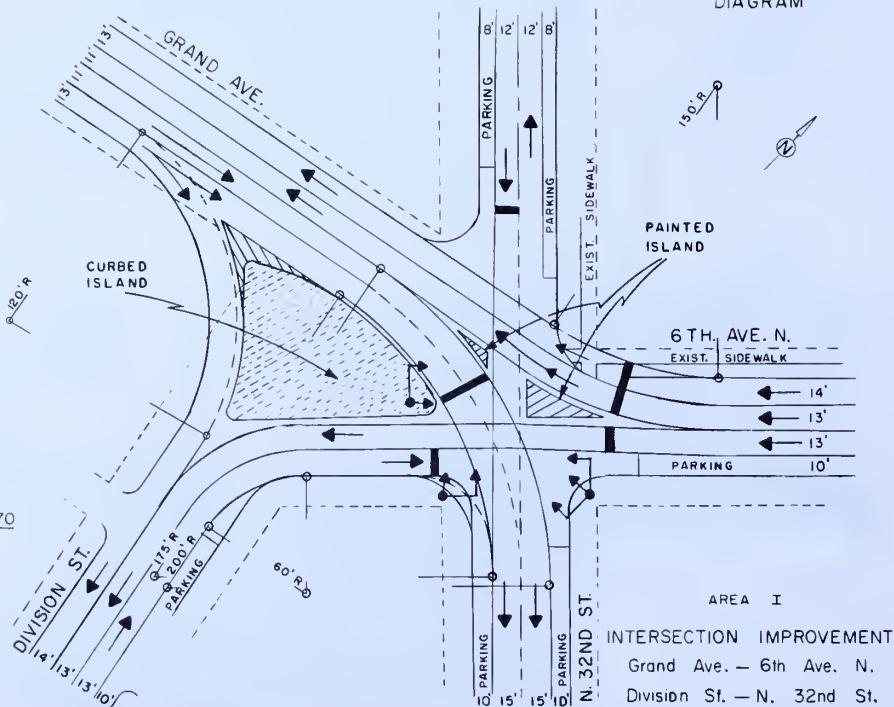
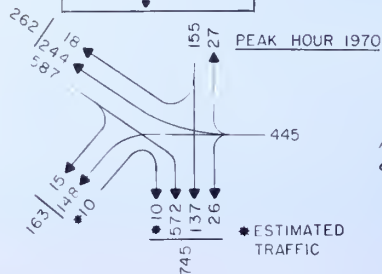
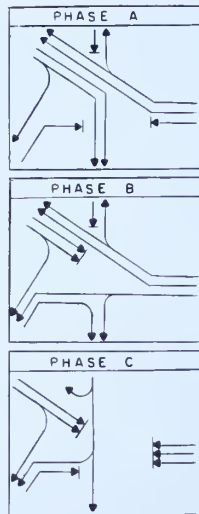


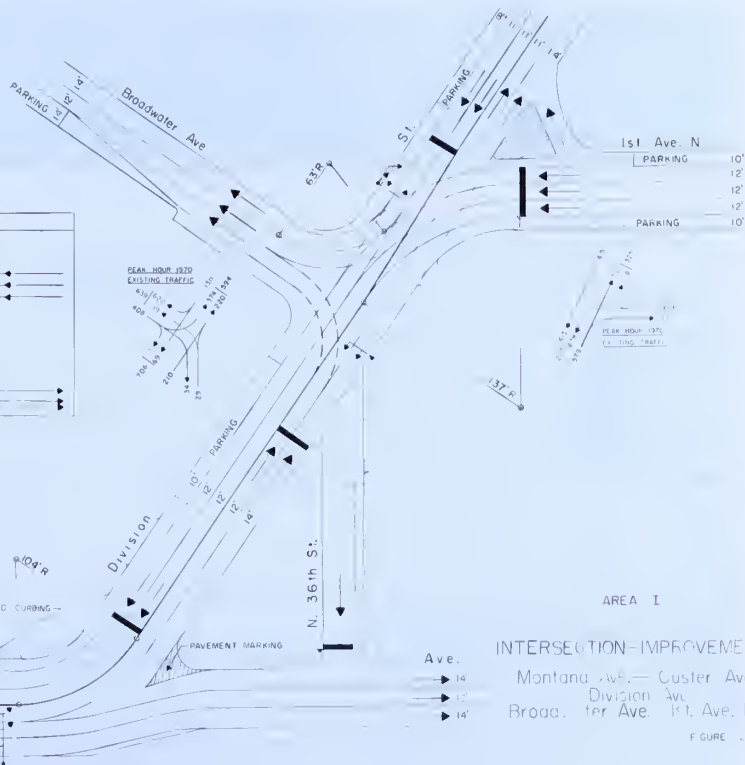
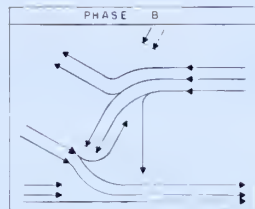
AREA I
TRUCK PARKING
ALTERNATES
MONTANA AVE
FIGURE 21



FIGURE 22

TRAFFIC VOLUME DIAGRAM





BILLINGS TOPICS

LEGEND

NO PARKING
METERED PARKING
RESTRICTED PARKING



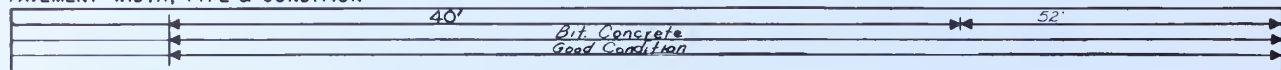
Principal Arterial

CLASSIFICATION

PARKING



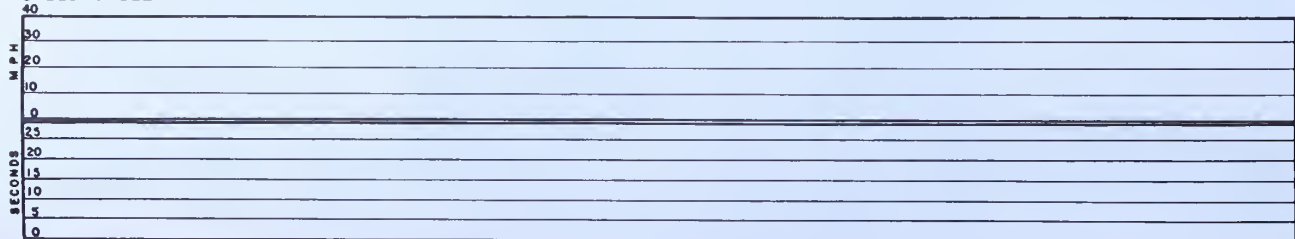
PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1965 THRU 1968

ANGLE	3	Montana and Division			
HEAD-ON					
REAR-END	7		2		
SIDE-SWIPE					
TURNING					
PARKING					
FIXED OBJECT	2				
PEDESTRIAN					
BACKING					
MISC.	3				
TOTAL	15		4	4	
			(66-68)	(67-68)	

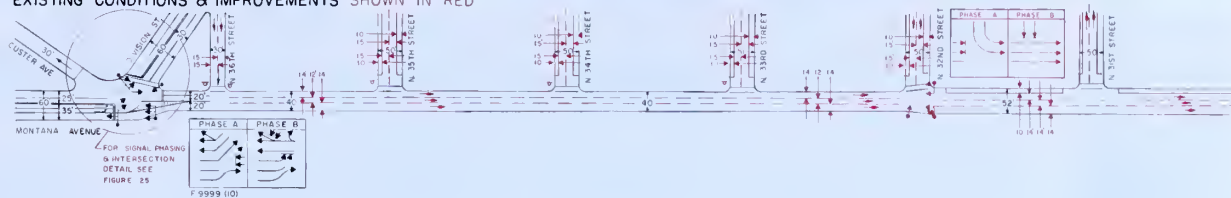
SPEED & DELAY



PLAN VIEW

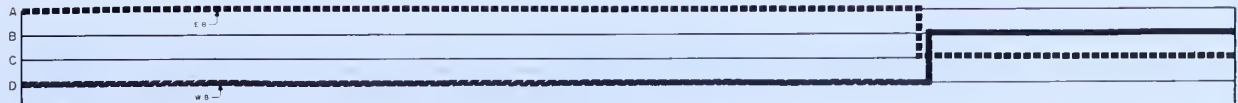


EXISTING CONDITIONS & IMPROVEMENTS SHOWN IN RED



TRAFFIC

LEVEL OF SERVICE



COSTS

SPECIAL D	TYPE C	TYPE C	TYPE C	TYPE C	TYPE A	TYPE C
\$ 7,500	\$ 350	\$ 350	\$ 350	\$ 350	\$ 11,500	\$ 350
PAVEMENT MARKING						
\$ 450						
TOTAL COST THIS SECTION						\$ 20,750

MONTANA AVE.

BILLINGS TOPICS

LEGEND

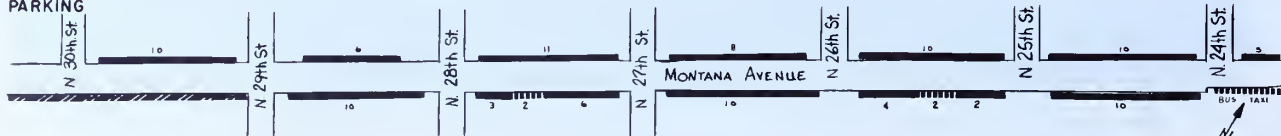
NO PARKING
METERED PARKING
RESTRICTED PARKING



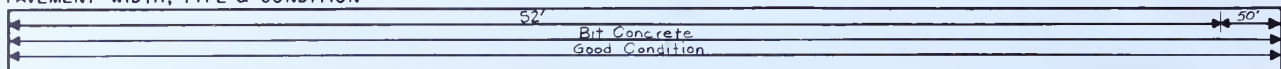
CLASSIFICATION

Principal Arterial

PARKING



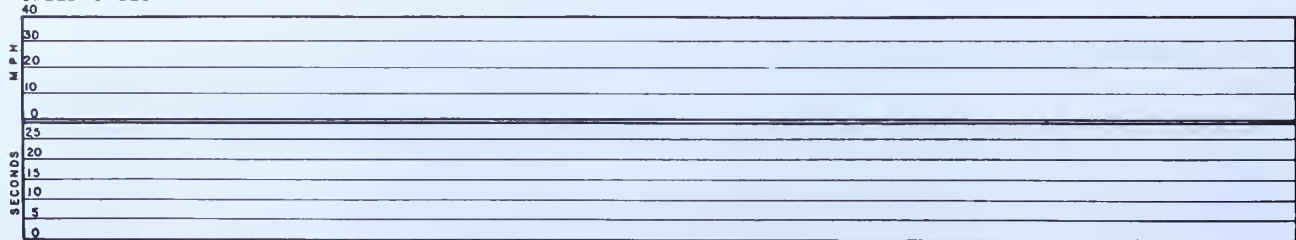
PAVEMENT WIDTH, TYPE & CONDITION



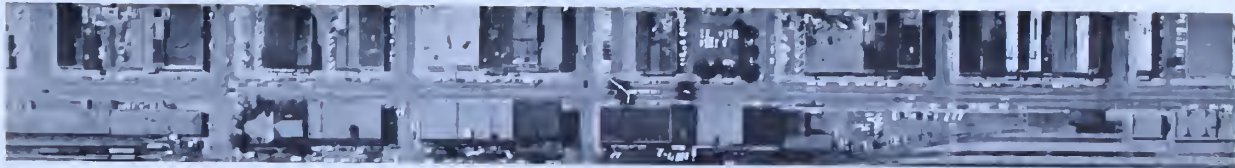
ACCIDENT SUMMARY 1965 THRU 1968

	ANGLE	3	3	6			
1	HEAD-ON			2		2	2
2	REAR-END	4	3				
	SIDESWIPE			4	6		2
1	TURNING	4	2	2	2		1
	PARKING			1			
	FIXED OBJECT			3	1		1
	PEDESTRIAN			1			
	BACKING						
	MISC.						
TOTAL	4	11	8	19	13	8	
	(66-68)	(66-68)	(66-67)	(66-68)	(66-68)	(66-69)	

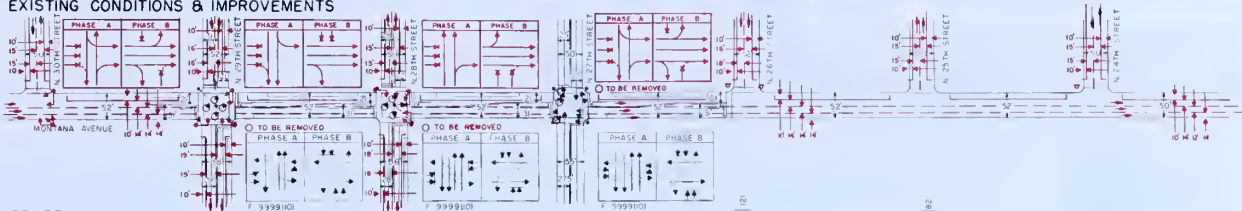
SPEED & DELAY



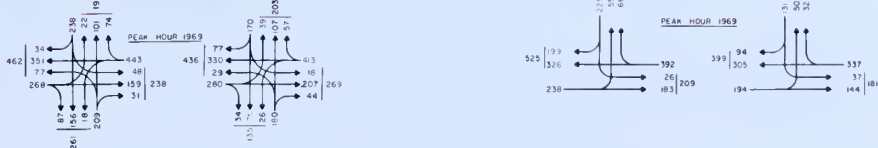
PLAN VIEW



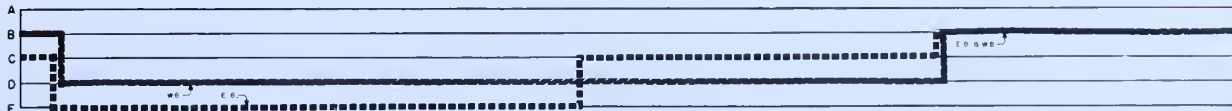
EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE



COSTS						
TYPE B	TYPE A	TYPE A	TYPE B	TYPE C	TYPE C	TYPE D
\$11,500	\$11,500	\$11,500	\$11,500	\$350	\$350	\$350
PAVEMENT MARKING \$350						
TOTAL COST THIS SECTION = \$37,250						

MONTANA AVE.

BILLINGS TOPICS

LEGEND

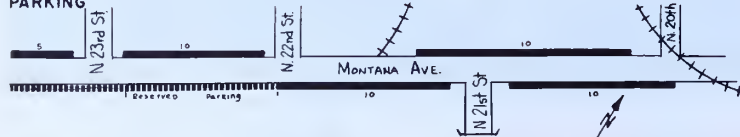
NO PARKING
METERED PARKING
RESTRICTED PARKING



CLASSIFICATION

Principal Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

50'	52'
Bit Concrete	
Fair to Good Condition	

ACCIDENT SUMMARY 1965 THRU 1968

ANGLE
HEAD-ON
REAR-END
SIDE SWIPE
TURNING
PARKING
FIXED OBJECT
PEDESTRIAN
BACKING
MISC.
TOTAL

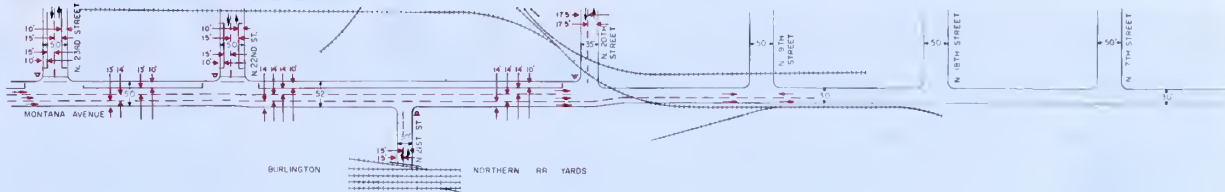
SPEED & DELAY

40
30
20
10
0
25
20
15
10
5
0

PLAN VIEW

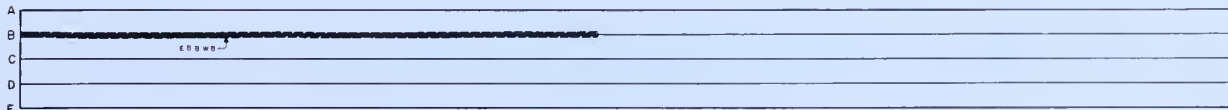


EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE



COSTS

TYPE D	TYPE D	TYPE D	TYPE D
\$350	\$350	\$350	\$350
PAVEMENT MARKING			
\$250			
TOTAL COST THIS SECTION = \$1650			

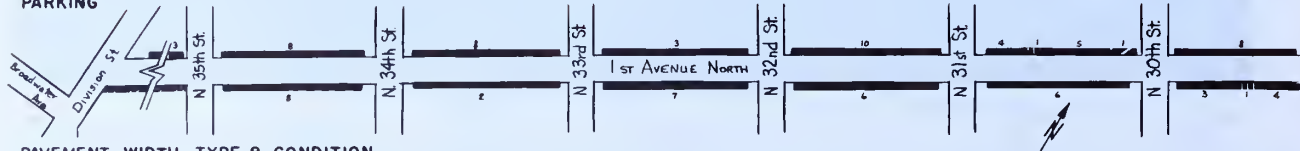
MONTANA AVE.

LEGEND

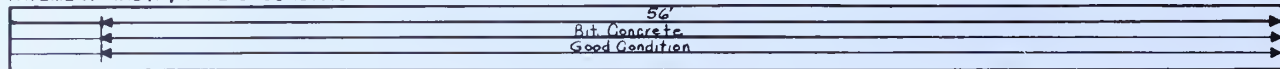
NO PARKING
METERED PARKING
RESTRICTED PARKING

Principal Arterial

PARKING



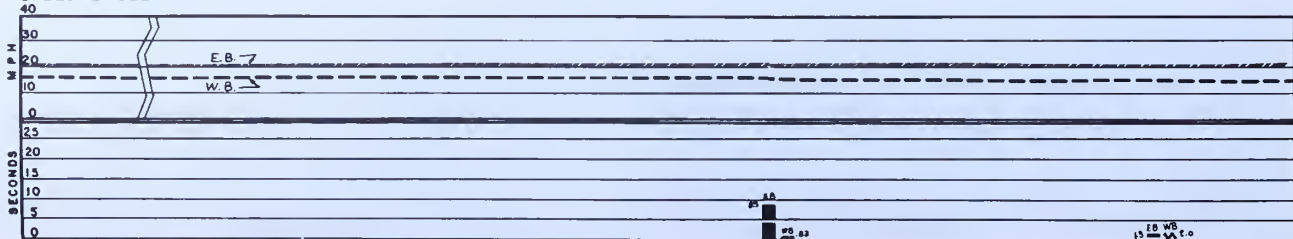
PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1965 THRU 1968

	3	ANGLE				4		
	10	HEAD-ON						1
	4	REAR-END		1		8		
	4	SIDESWIPK				5		
	4	TURNING				6		
	4	PARKING		1		1		
		FIXED OBJECT				2		
		PEDESTRIAN						
	1	BACKING						
		MISC.						
	TOTAL 27			2		27		1
	(66-68)					(66-68)		

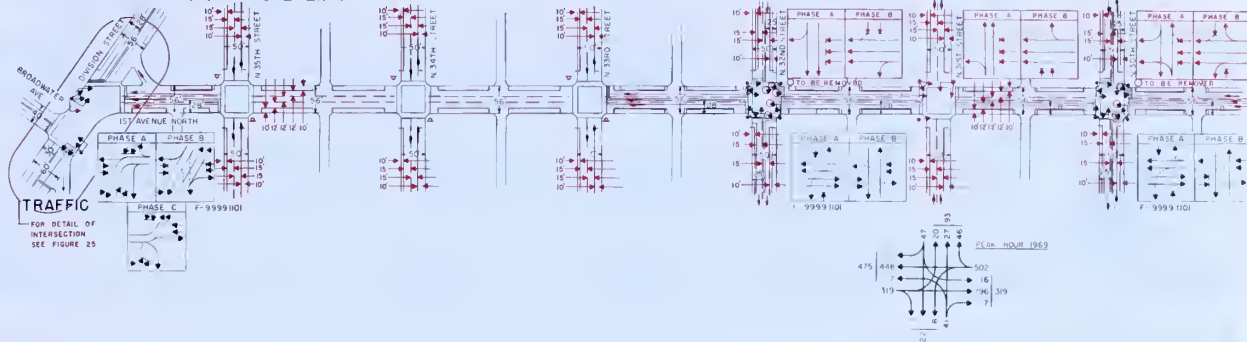
SPEED & DELAY



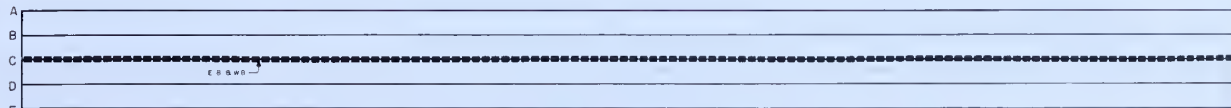
PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



LEVEL OF SERVICE



COSTS

SPECIAL C	TYPE D	TYPE O	TYPE D	TYPE A	TYPE A	TYPE B
\$5,000	\$350	\$350	\$350	\$11,500	\$11,500	\$11,500
PAVEMENT MARKING						
\$700						
TOTAL COST THIS SECTION = \$40,550						

1st. AVE. NO.

BILLINGS TOPICS

LEGEND

CLASSIFICATION

Principal Arterial

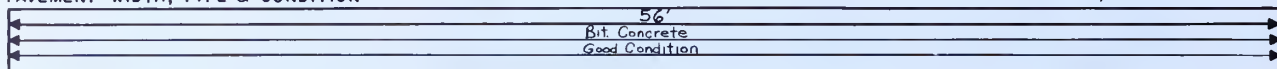
NO PARKING
METERED PARKING
RESTRICTED PARKING

NO PARKING
METERED PARKING
RESTRICTED PARKING

PARKING



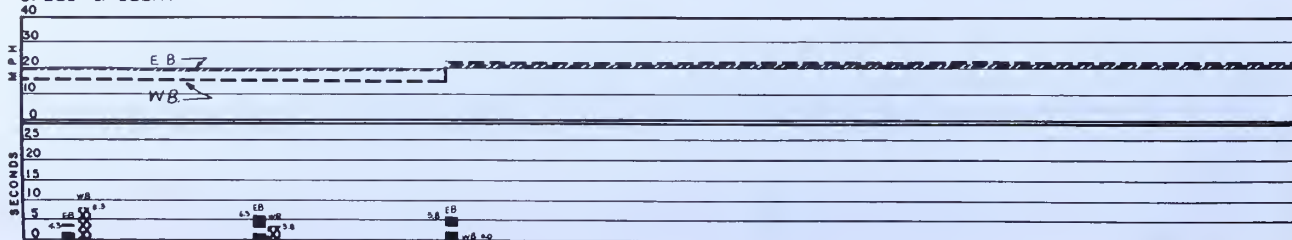
PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1965 THRU 1968

6	ANGLE	4	23	2	2
10	HEAD-ON	19	10	11	8
	REAR-END	2			
5	SIDESWIP	4	4	7	3
1	TURNING				
	PARKING		1		
	FIXED OBJECT			2	
	PEDESTRIAN	1		1	
	BACKING				
	MISC.				
TOTAL 22		31	42	24	14
(66-68)		(66-68)	(66-68)	(66-68)	(66-68)

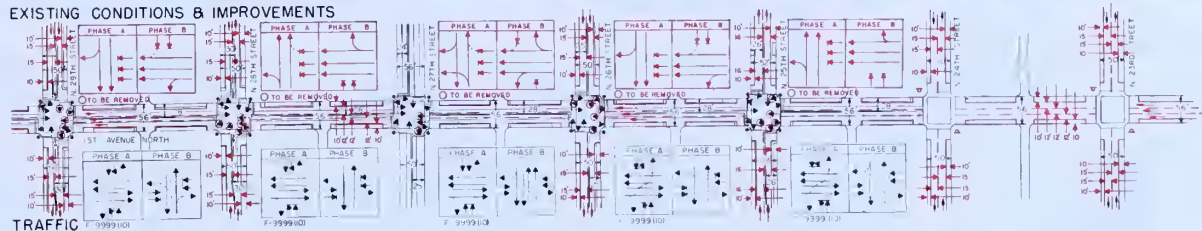
SPEED & DELAY



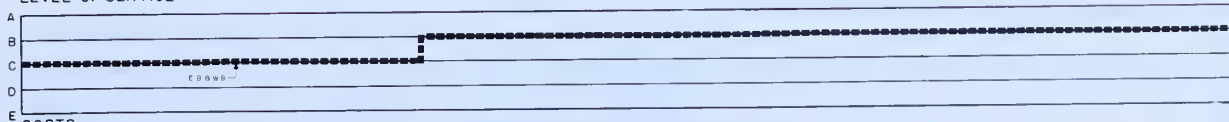
PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



LEVEL OF SERVICE



TYPE A	TYPE A	TYPE B	TYPE C	TYPE C	TYPE D	TYPE D
\$11,500	\$11,500	\$1,150	\$350	\$350	\$350	\$350
Pavement Marking						

BILLINGS TOPICS

LEGEND

NO PARKING
METERED PARKING
RESTRICTED PARKING



CLASSIFICATION

Principal Arterial

PARKING



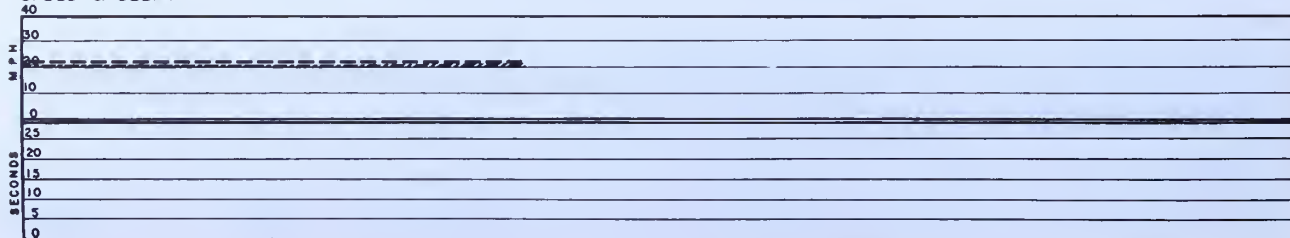
PAVEMENT WIDTH, TYPE & CONDITION

56'	
Bit Concrete	
Good Condition	

ACCIDENT SUMMARY 1965 THRU 1968

ANGLE
HEAD-ON
REAR-END
SIDE SWIPE
TURNING
PARKING
FIXED OBJECT
PEDESTRIAN
BACKING
MISC.
TOTAL

SPEED & DELAY



TRAFFIC

A diagram of a 5-line musical staff. The lines are labeled A, B, C, D, and E from top to bottom. A dashed line is drawn on the B line, and a bracket below it is labeled "E D C B A".

TYPE D	TYPE D
\$350	\$350
T. MARPINS	

BILLINGS TOPICS

LEGEND

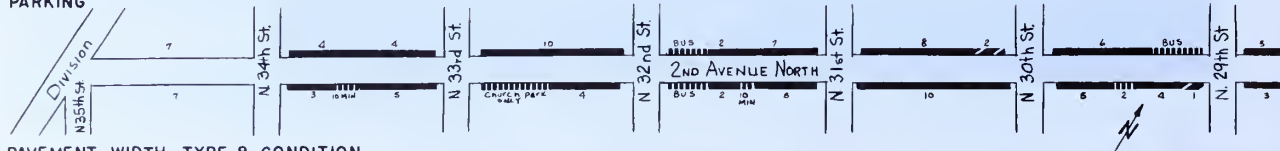
CLASSIFICATION

NO PARKING
METERED PARKING
RESTRICTED PARKING

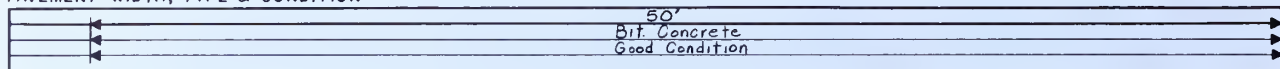


Local Street

PARKING



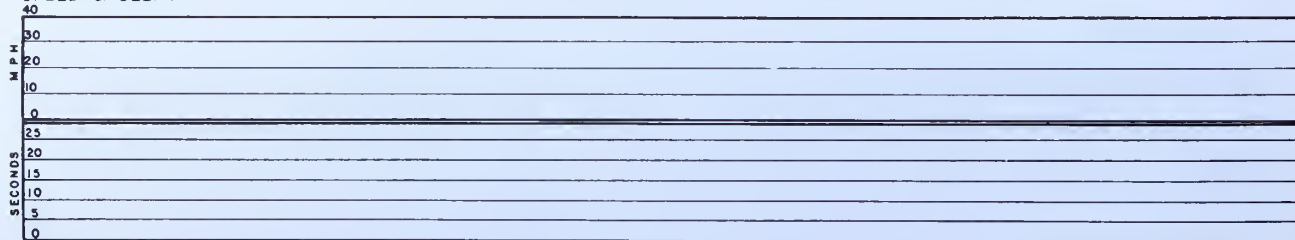
PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1965 THRU 1968

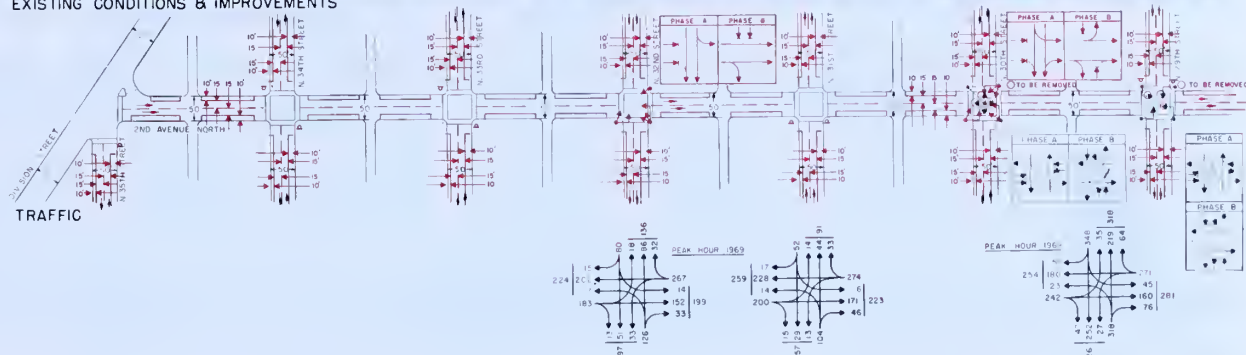
ANGLE	3	4
HEAD-ON	6	6
REAR-END	4	4
SIDEWIPES	2	3
TURNING		
PARKING		
FIXED OBJECT		
PEDESTRIAN	1	
BACKING		
MISC.		
TOTAL	12 (66-68)	17 (66-68)

SPEED & DELAY

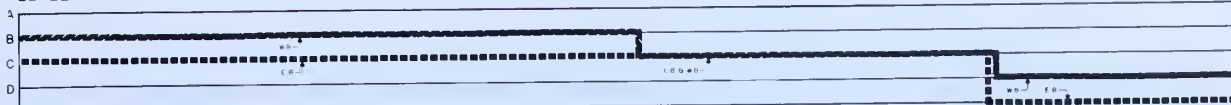




EXISTING CONDITIONS & IMPROVEMENTS



LEVEL OF SERVICE



COSTS						
TYPE D	TYPE D	TYPE D	TYPE A	TYPE C	TYPE B	TYPE C
\$350	\$350	\$350	\$11,500	\$350	\$11,500	\$350
			PAVEMENT MARKING			
			\$500			
						TOTAL COST THIS SECTION - \$25,250

BILLINGS TOPICS

LEGEND

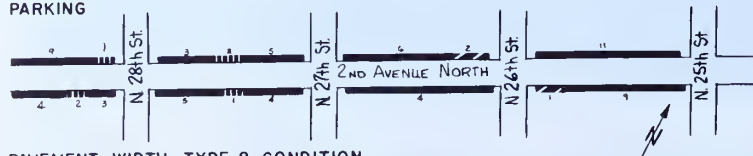
NO PARKING
 VETERED PARKING
 RESTRICTED PARKING



CLASSIFICATION

Local Street

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

50'
Bit Concrete
Good Condition

ACCIDENT SUMMARY 1965 THRU 1968

1	ANGLE			6		6		5
1	HEAD-ON							
1	REAR-END	1		8		4		1
1	SIDEWIPK			1				
9	TURNING			5		2		
1	PARKING							
1	FIXED OBJECT							1
1	PEDESTRIAN			3		1		
1	BACKING	1		1				
1	MISC.			1				
TOTAL 28		2		26		13		5
(66-68)				(66-68)		(67-68)		(66-68)

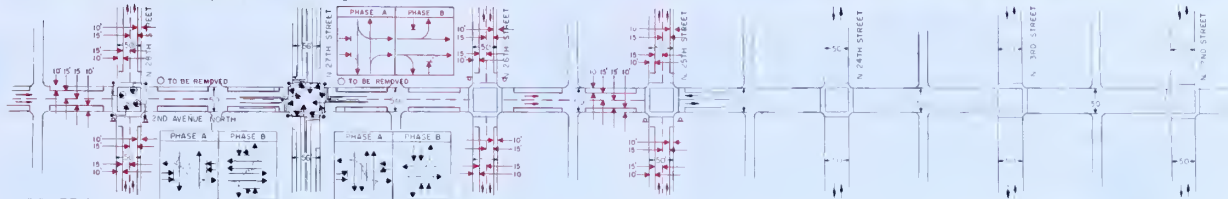
SPEED & DELAY

40
30
20
10
0
23
20
15
10
5
0

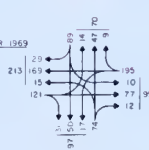
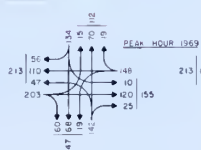
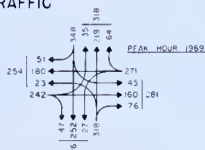
PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE



COSTS

TYPE C	TYPE B	TYPE C	TYPE C
\$350	\$1,150	\$350	\$350
PAVEMENT MARKING			
\$300			
TOTAL COST THIS SECTION: \$2,500			

2nd. AVE N

BILLINGS TOPICS

LEGEND

NO PARKING
METERED PARKING
RESTRICTED PARKING



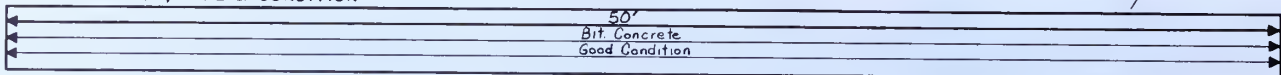
CLASSIFICATION

Local Street

PARKING



PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1965 THRU 1968

ANGLE	13	3	1	2	2
HEAD-ON					
REAR-END	2	4		5	9
SIDESWIPE		1			
TURNING	2	3		6	4
PARKING				1	3
FIXED OBJECT					
PEDESTRIAN					
BACKING					1
MISC.					1
TOTAL	17	11		14	24
	(70-71)	(66-68)		(66-68)	(66-68)

SPEED & DELAY

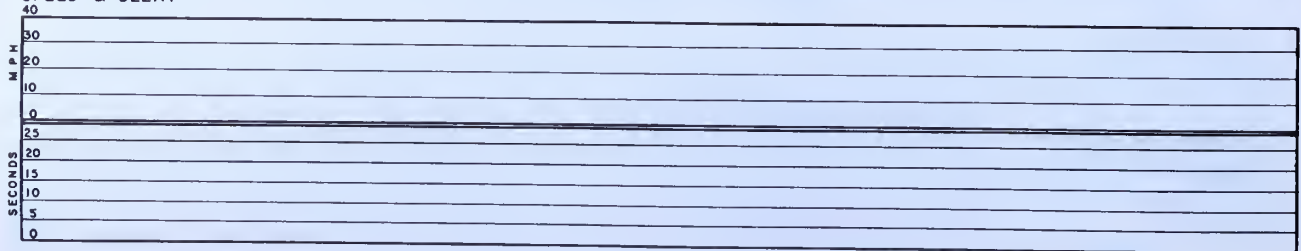


Figure 1 consists of four network diagrams arranged horizontally, each representing a different year from 1967 to 1969. Each diagram is a directed graph with nodes and edges. The nodes are labeled with numbers, and the edges are labeled with numbers. The diagrams show a progression from a single peak hour in 1967 to a more complex, multi-peaked structure in 1969.

- 1967:** A single peak hour. The network has 10 nodes. The central node is labeled 244. The edges are labeled with numbers: 27, 108, 176, 38, 19, 292, 116, 151, 16, 126, 92, 67, 19, 137, 215, 7.
- 1968:** Two peak hours. The network has 10 nodes. The central node is labeled 326. The edges are labeled with numbers: 27, 60, 86, 18, 315, 8, 152, 184, 24, 78, 11, 161, 13, 266, 137, 326.
- 1969:** Three peak hours. The network has 10 nodes. The central node is labeled 303. The edges are labeled with numbers: 35, 243, 200, 29, 215, 231, 33, 353, 37, 141, 211, 209, 256, 231, 33, 353, 37, 141, 211.
- 1970:** Four peak hours. The network has 10 nodes. The central node is labeled 239. The edges are labeled with numbers: 37, 168, 38, 265, 42, 209, 313, 204, 31, 287, 72, 198, 45, 146, 71, 302.

TYPE D	TYPE D	TYPE D	TYPE A	TYPE C	TYPE B	TYPE C
\$350	\$350	\$350	\$11,500	\$350	\$11,500	\$350
PAVEMENT MARKING						
			\$450			
						TOTAL COST THIS SECTION = \$25,200

3rd AVE. N.

BILLINGS TOPICS

LEGEND

NO PARKING
METERED PARKING
RESTRICTED PARKING



CLASSIFICATION

Local Street

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

50'	
Bit Concrete	
Good Condition	

ACCIDENT SUMMARY 1965 THRU 1968

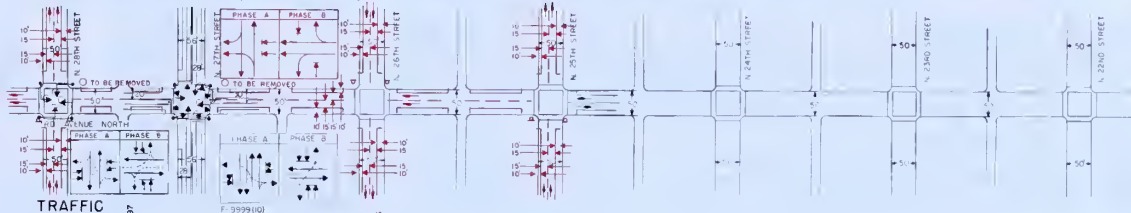
	ANGLE	4	2	4
1 HEAD-ON				
REAR-END	6	3		
SIDE SWIPE	2			
TURNING	2			1
PARKING	3			
FIXED OBJECT				
PEDESTRIAN				
BACKING	1			
MISC.				
TOTAL	18	5	5	
	(66-68)	66-68)	(67-68)	

SPEED & DELAY

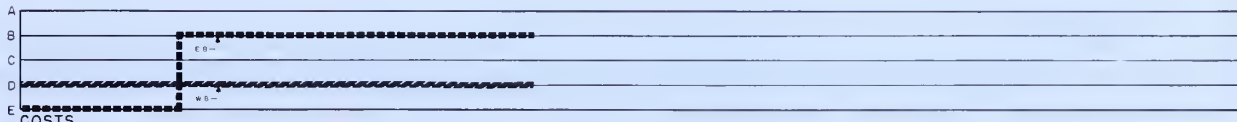
40	
30	
20	
10	
0	
25	
20	
15	
10	
5	
0	



EXISTING CONDITIONS & IMPROVEMENTS



LEVEL OF SERVICE



COSTS

TYPE C	TYPE B	TYPE C	TYPE C
\$350	\$1,150	\$350	\$350
PAVEMENT MARKING			
\$250			
TOTAL COST THIS SECTION = \$2,450			

LEGEND

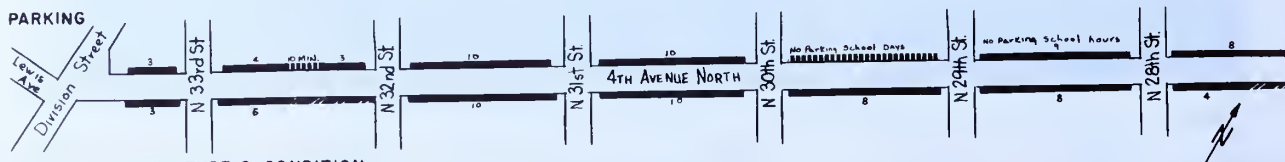
CLASSIFICATION

Collector Street

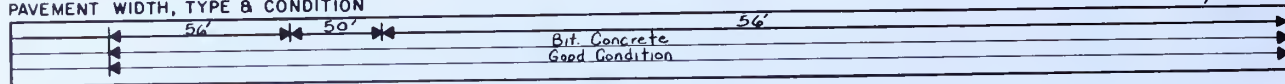
NO PARKING
METERED PARKING
RESTRICTED PARKING

00000000

PARKING



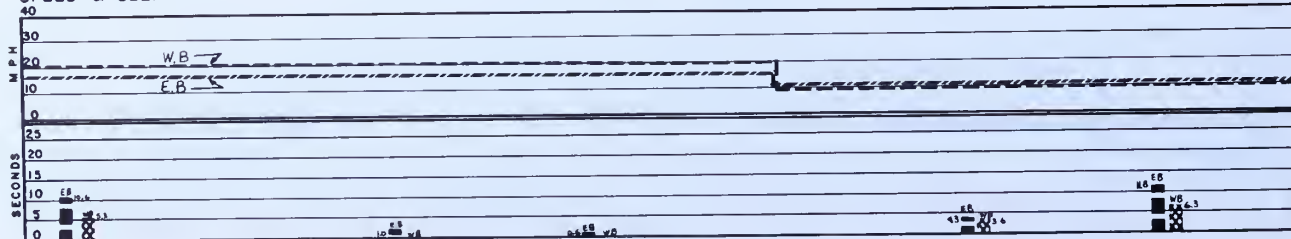
PAVEMENT WIDTH, TYPE & CONDITION



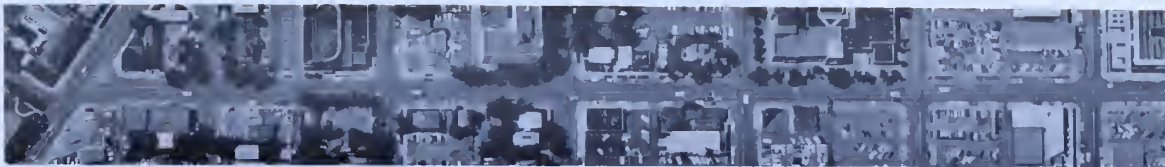
ACCIDENT SUMMARY 1965 THRU 1968

ACCIDENT SUMMARY 1965 THRU 1968									
		ANGLE		2			6	6	5
	7	HEAD-ON					8	3	3
		REAR-END	1	5					
		SIDE SWIPE	2		2		4		4
	9	TURNING			2		6	4	1
		PARKING							
		FIXED OBJECT	1		1		1		1
		PEDESTRIAN							
		BACKING							
		MISC.		1 (BICYCLE)			3		1
TOTAL	16		4	9	3		28	13	17
	(65-68)		(1971)	(1971)	(1971)		(66-68)	(66-68)	(66-68)

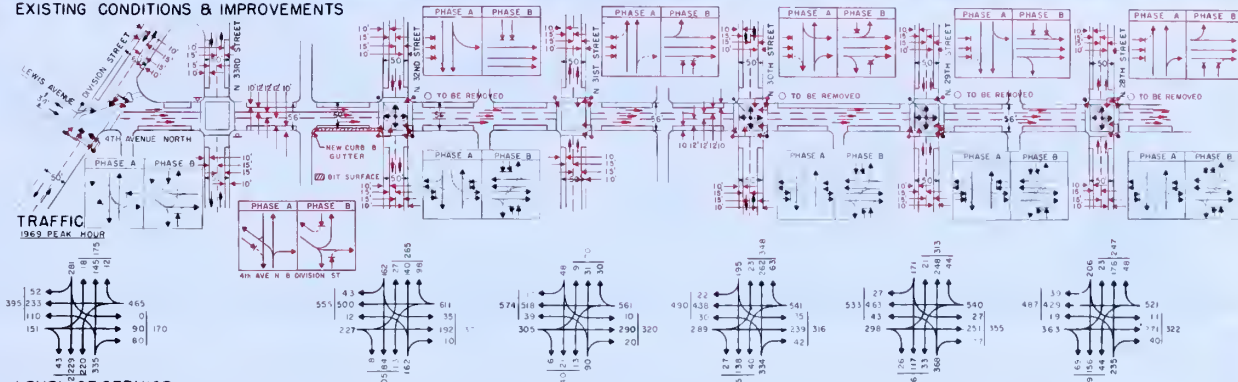
SPEED & DELAY



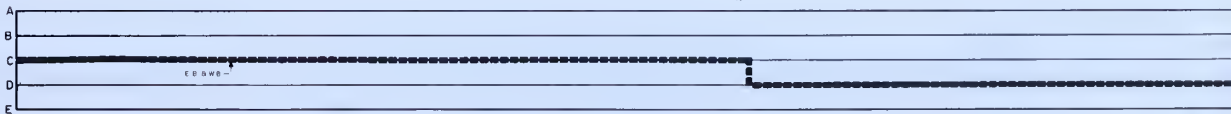
PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



LEVEL OF SERVICE



COSTS

SPECIAL A	TYPE D	TYPE A	TYPE A	TYPE B	TYPE A	TYPE A
\$11,500	\$350	\$13,800	\$11,500	\$11,500	\$11,500	\$11,500
		NEW CURB & GUTTER SURFACING - \$7,000	PAVEMENT MARKING \$250		TOTAL COST THIS SECTION = \$72,900	

4th AVE N

BILLINGS TOPICS

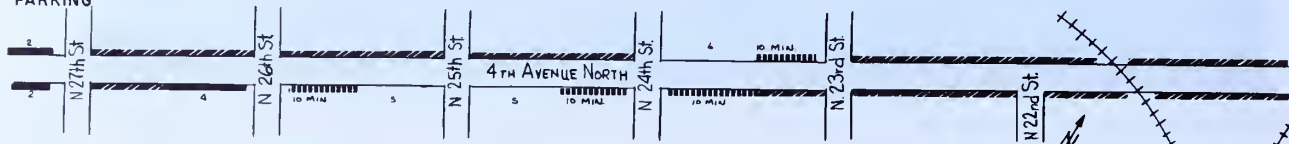
LEGEND

NO PARKING
METERED PARKING
RESTRICTED PARKING

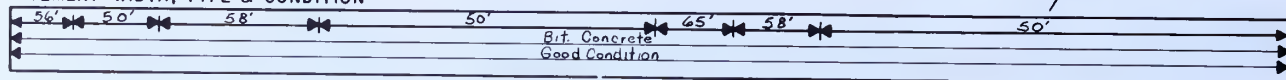


Collector Street

PARKING



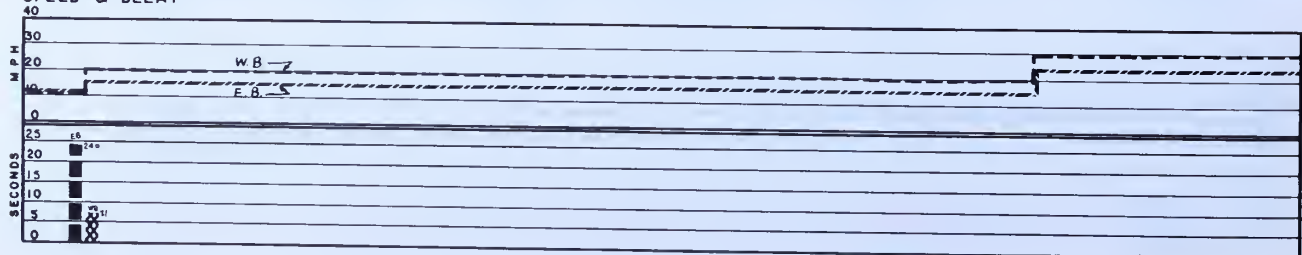
PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1965 THRU 1968

14	ANGLE	19	5	5		
2	HEAD-ON	2				1
	REAR-END					
4	SIDE SWIPE					
	TURNING	2	3	3		2
	PARKING	1				
	FIXED OBJECT					
1	PEDESTRIAN		1			
	BACKING					
	MISC.					
TOTAL	22	24	10	8	3	
	(66-68)	(66-68)	(66-68)	(1971)	(1971)	

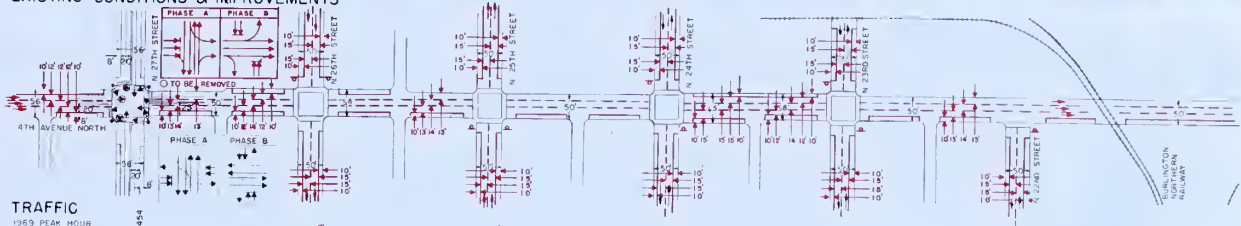
SPEED & DELAY



PLAN VIEW

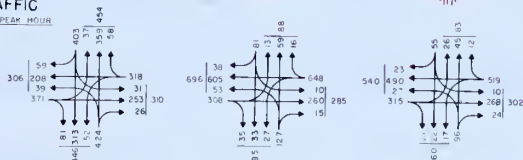


EXISTING CONDITIONS & IMPROVEMENTS

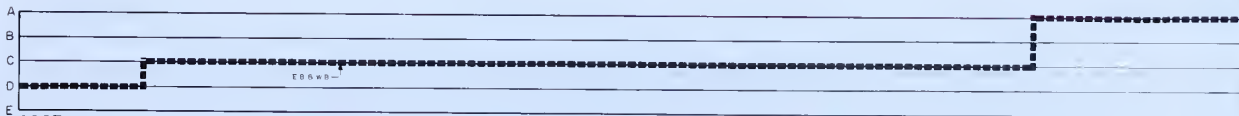


TRAFFIC

1959 PEAK HOUR



LEVEL OF SERVICE



COSTS



4th AVE. N

BILLINGS TOPICS

LEGEND

NO PARKING
METERED PARKING
RESTRICTED PARKING



CLASSIFICATION

Collector St.

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

50'
Bit. Concrete
Good Condition

ACCIDENT SUMMARY 1965 THRU 1968

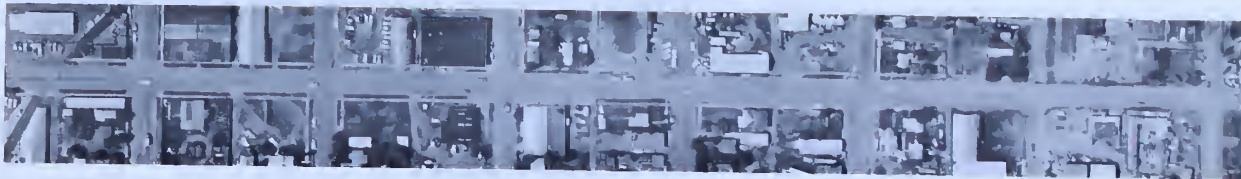
ANGLE	4
HEAD-ON	3
REAR-END	1
SIDE SWIPE	1
TURNING	2
PARKING	
FIXED OBJECT	2
PEDESTRIAN	
BACKING	
MISC.	
TOTAL	13

(1971)

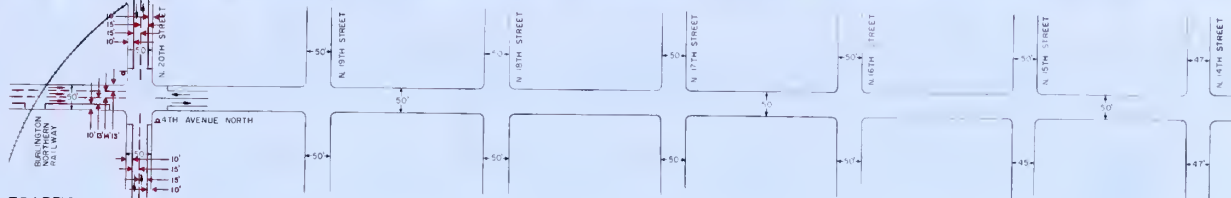
SPEED & DELAY



PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

A	-----
B	-----
C	-----
D	-----
E	-----

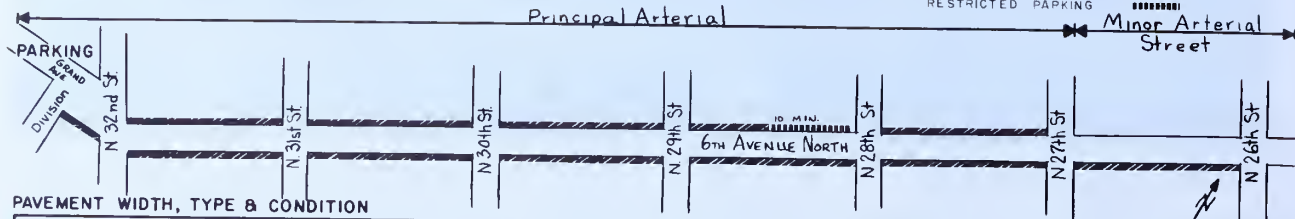
COSTS

TYPE D	
\$350	
PAVEMENT MARKING	
\$100	
TOTAL COST THIS SECTION = \$450	

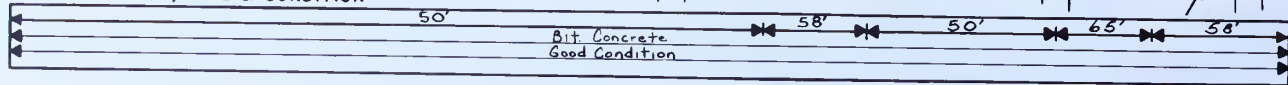
4th AVE N

LEGEND

NO PARKING
METERED PARKING
RESTRICTED PARKING



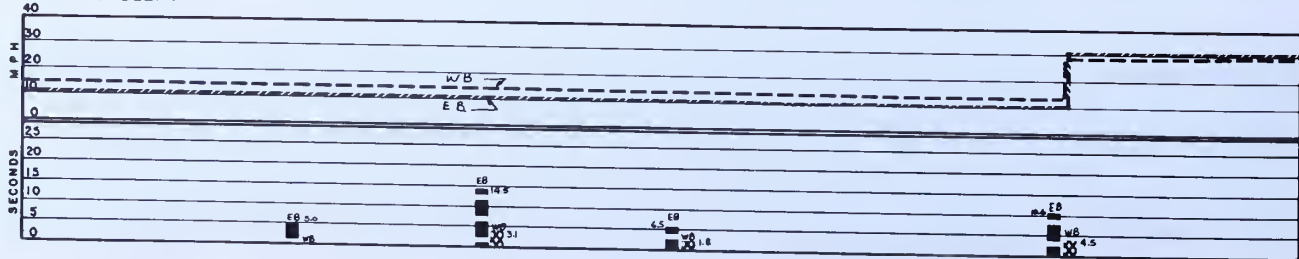
PAVEMENT WIDTH, TYPE & CONDITION



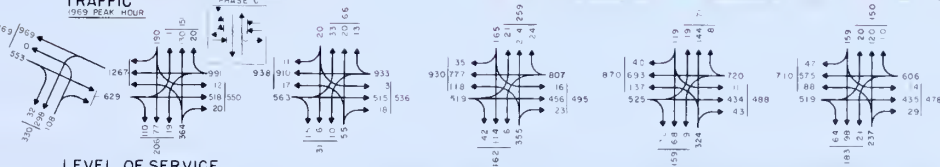
ACCIDENT SUMMARY 1965 THRU 1968

ANGLE	6	20	15	15	42	1
HEAD-ON	6	22	22	8	19	1
REAR-END	6	3	5	5	21	2
SIDE-SWIRE	6	8			1	
TURNING						
PARKING						
FIXED OBJECT						
PEDESTRIAN	1	1	1		1	
BACKING	1				1	
MISC.						
TOTAL	20	55	43	30	89	4
	(66-68)	(66-68)	(66-68)	(66-68)	(66-68)	(67-68)

SPEED & DELAY



TRAFFIC



A

B

C

D

E C H W

F

SPECIAL B \$40,000	TYPE B \$13,800	TYPE B \$11,500	TYPE A \$11,500	TYPE A \$11,500	TYPE B \$1,150	TYPE C \$350
			PAVEMENT MARKING			
			\$750		TOTAL COST THIS SECTION: \$90,550	

BILLINGS TOPICS

LEGEND

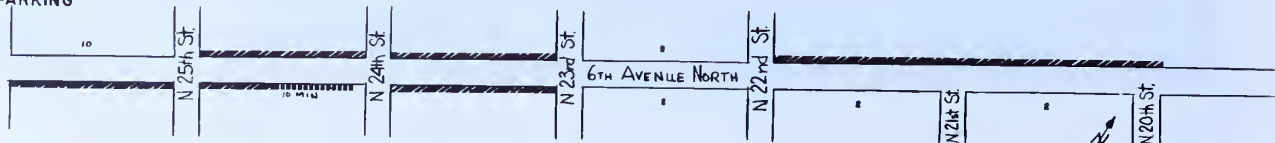
CLASSIFICATION

NO PARKING
METERED PARKING
RESTRICTED PARKING

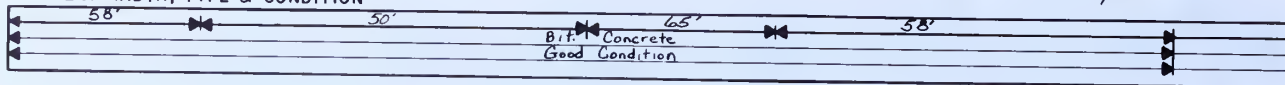


Minor Arterial Street

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

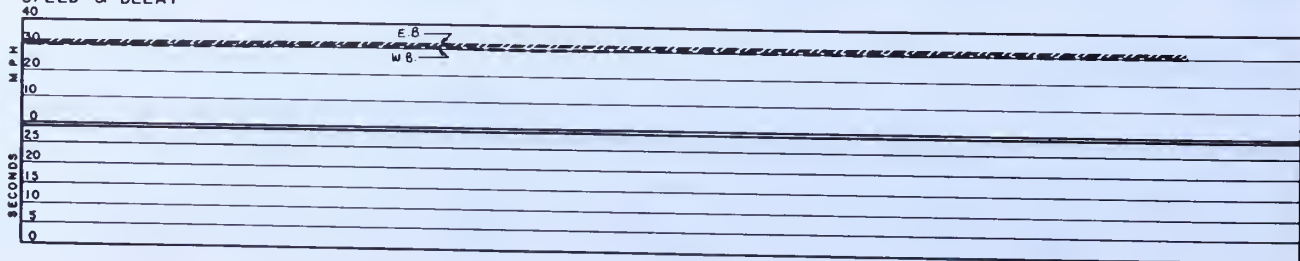


ACCIDENT SUMMARY 1965 THRU 1968

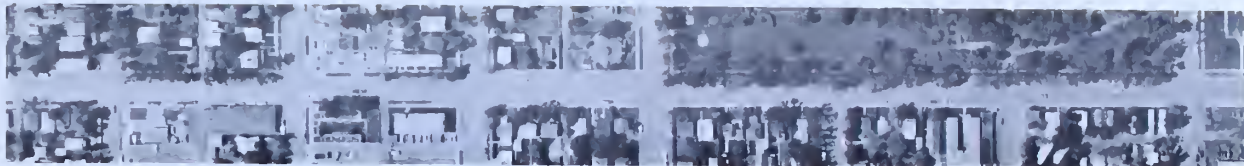
ANGLE	
HEAD-ON	
REAR-END	
SIDESWIPE	
TURNING	
PARKING	
FIXED OBJECT	
PEDESTRIAN	
BACKING	
MISC.	
TOTAL	3

(67-68)

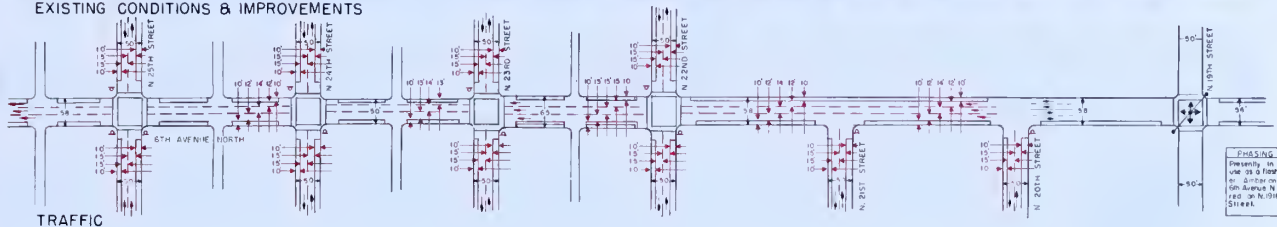
SPEED & DELAY



PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



LEVEL OF SERVICE



COSTS

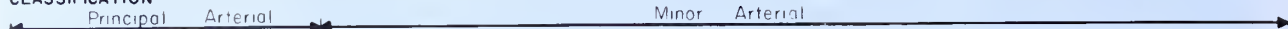
TYPE C	TYPE D	TYPE D	TYPE D	TYPE D	TYPE D
\$350	\$350	\$350	\$350	\$350	\$350
PAVEMENT MARKING					
\$600					
TOTAL COST THE SECTION = \$2,200					

BILLINGS TOPICS

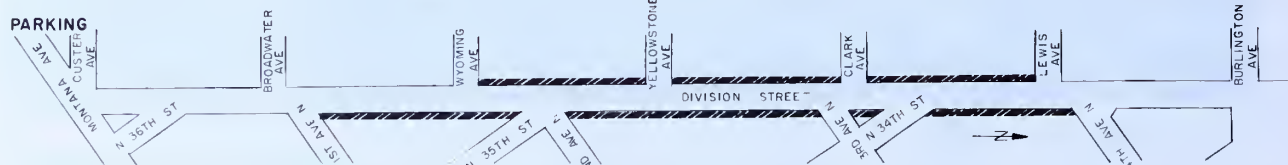
LEGEND

NO PARKING

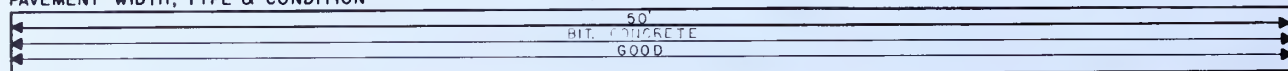
CLASSIFICATION



PARKING



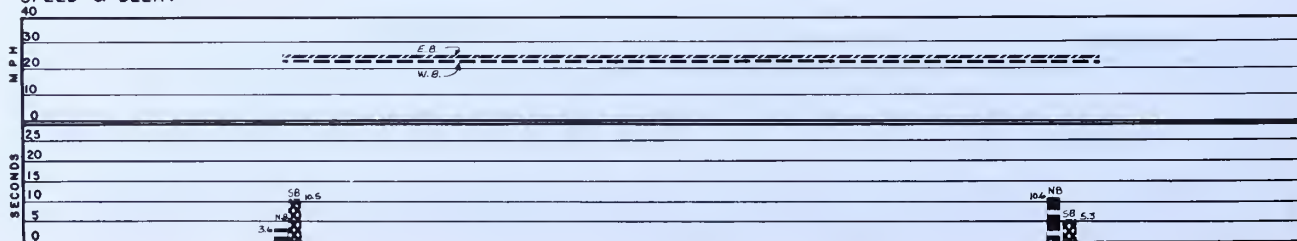
PAVEMENT WIDTH, TYPE & CONDITION



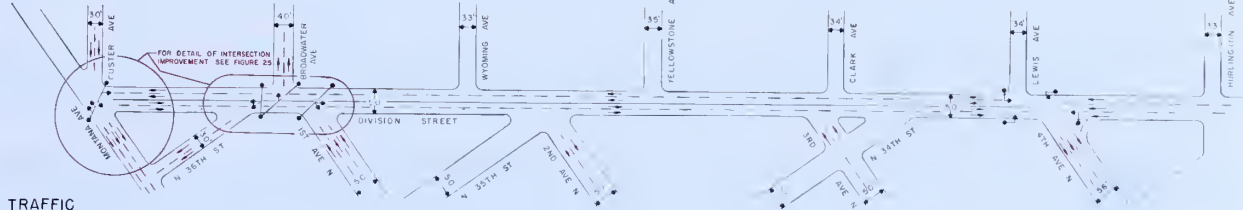
ACCIDENT SUMMARY 1965 THRU 1968

3	ANGLE	1		
	HEAD-ON	3		
7	REAR-END	10		7
	SIDE SWIPE	4		
	TURNING	4		9
2	PARKING			
	FIXED OBJECT	4		
	PEDESTRIAN			
	BACKING	1		
3	MISC.			
TOTAL 15		27		16
(NOT COMPLETE)		(66-6B)		(66-66)

SPEED & DELAY

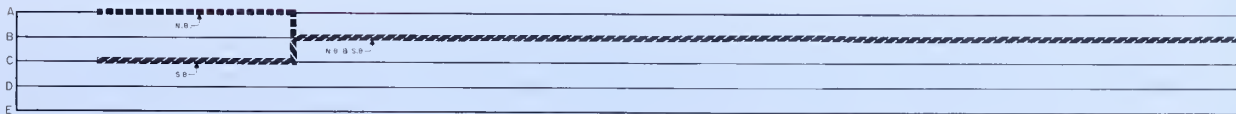


EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

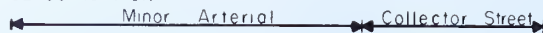


COSTS

FOR COST OF IMPROVEMENT SEE PAGES 31 & 37	

BILLINGS TOPICS

CLASSIFICATION



PARKING



PAVEMENT WIDTH, TYPE & CONDITION

50	
BIT. CONCRETE	
GOOD	

ACCIDENT SUMMARY 1965 THRU 1968

ANGLE	
HEAD-ON	
REAR-END	
SIDEWIDE	
TURNING	
PARKING	
FIXED OBJECT	
PEDESTRIAN	
BACKING	
MISC.	
TOTAL	

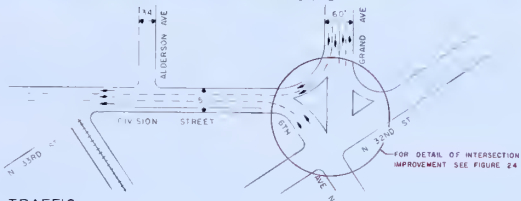
SPEED & DELAY

40	
30	
20	
10	
0	
25	
20	
15	
10	
5	
0	

PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

E	
D	
E	

COSTS

FOR COST OF IMPROVEMENT SEE PAGE 57

BILLINGS TOPICS

LEGEND

NO PARKING
METERED PARKING

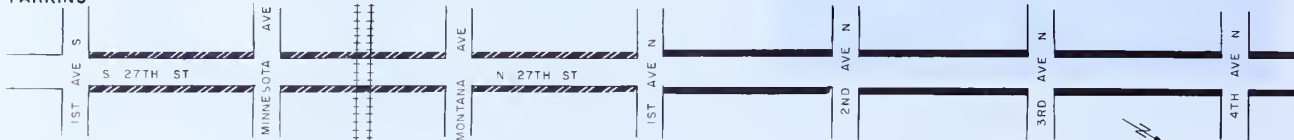


CLASSIFICATION

Principal Arterial

Minor Arterial

PARKING



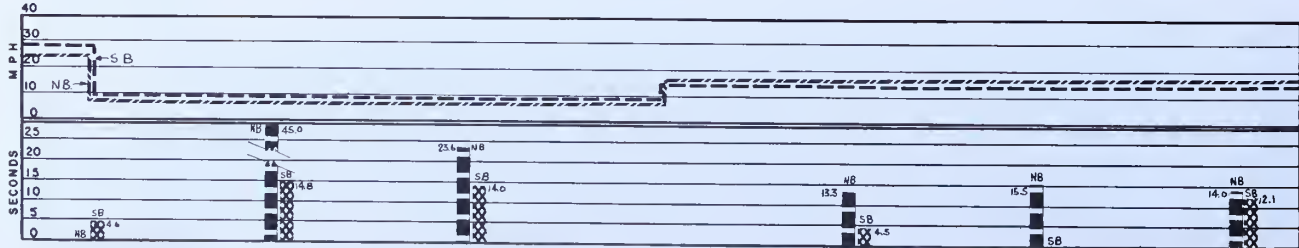
PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1965 THRU 1968

11	ANGLE	6	23	6	4	14
13	HEAD-ON	2	10	8	6	2
2	REAR-END	1	1	1	2	1
10	SIDESWIPE	4	4	5	5	4
	TURNING	2	1	1	1	1
	PARKING	1	1	1	1	1
	FIXED OBJECT	3	1	3	1	1
	PEDESTRIAN	1	1	1	1	1
	BACKING	1	1	1	1	1
	MISC.	1	1	1	1	1
TOTAL	36	19	42	25	18	22

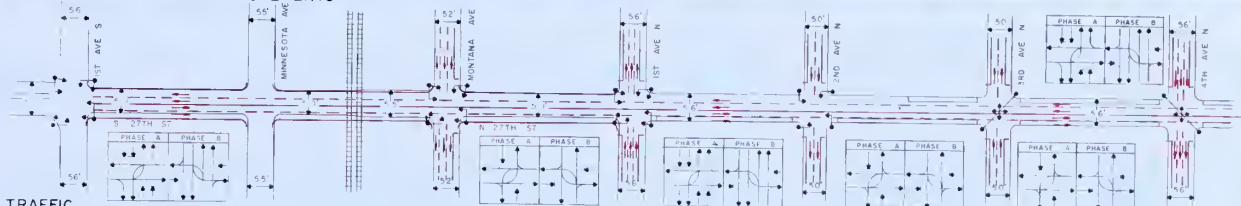
SPEED & DELAY



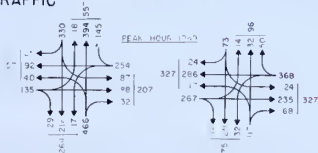
PLAN VIEW



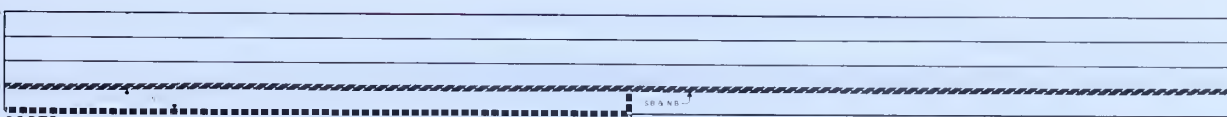
EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE



COSTS



BILLINGS TOPICS

LEGEND

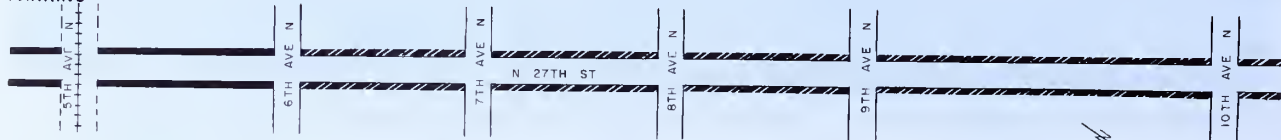
CLASSIFICATION

NO PARKING

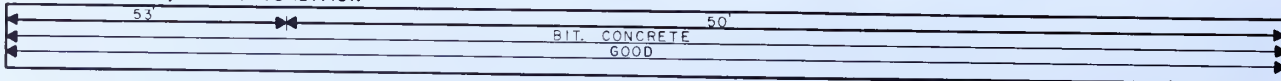
METERED PARKING

Minor Arterial

PARKING



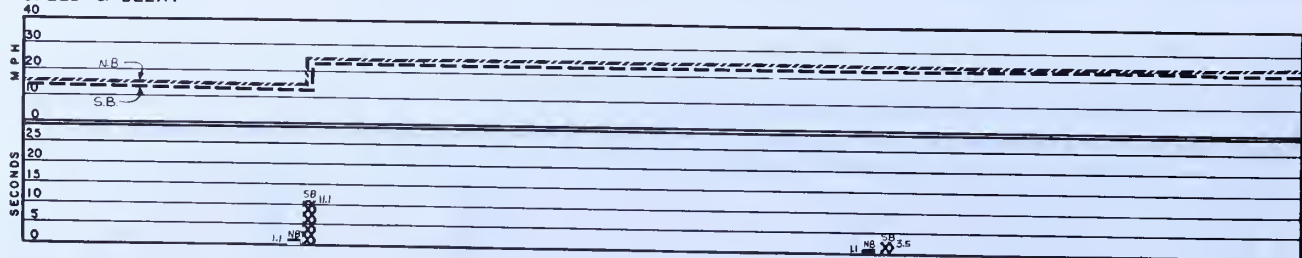
PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1965 THRU 1968

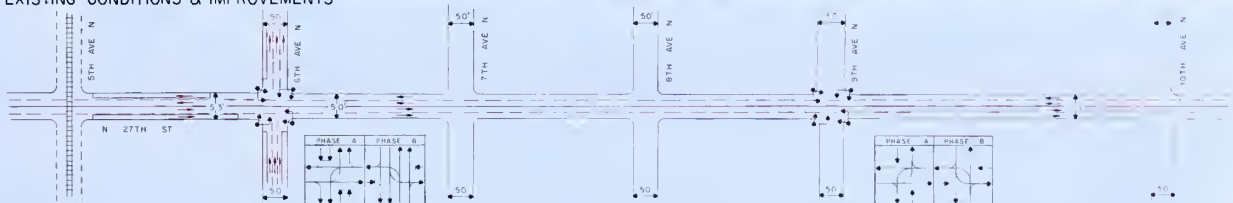
ANGLE	42
HEAD-ON	
REAR-END	19
SIDE SWIPE	2
TURNING	21
PARKING	1
FIXED OBJECT	1
PEDESTRIAN	1
BACKING	
MISC.	2
TOTAL	89

SPEED & DELAY



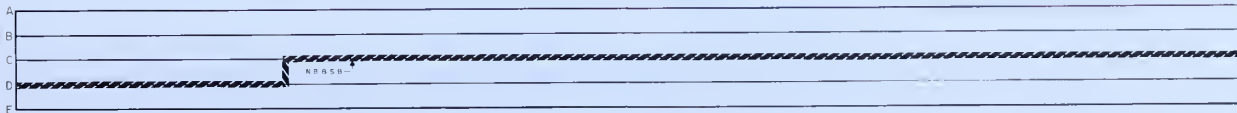


EXISTING CONDITIONS & IMPROVEMENTS

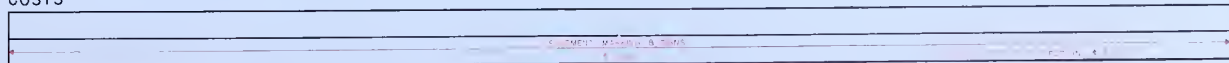


TRAFFIC

LEVEL OF SERVICE



COSTS



BILLINGS TOPICS

LEGEND

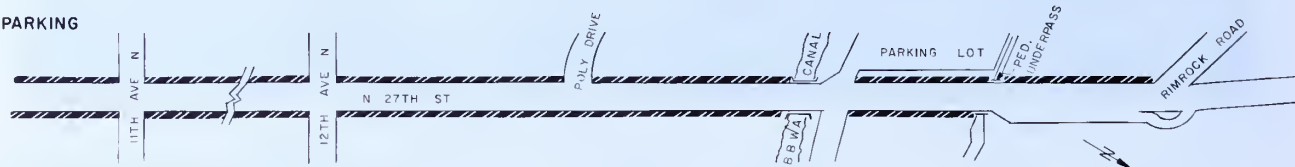
NO PARKING
METERED PARKING



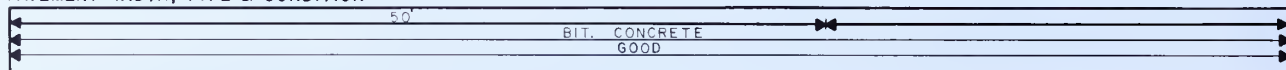
CLASSIFICATION

Minor Arterial

PARKING



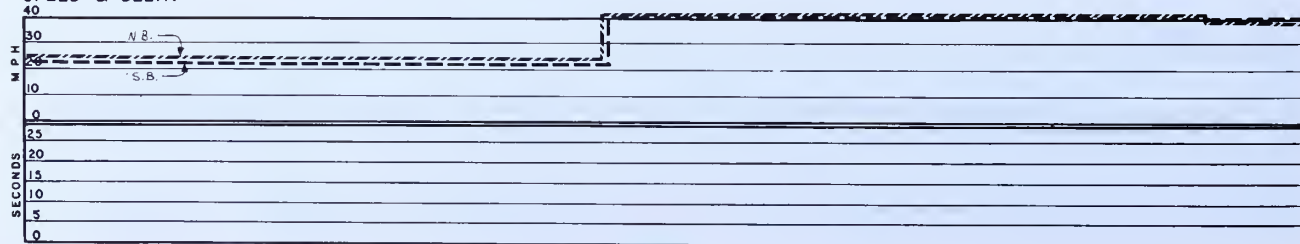
PAVEMENT WIDTH, TYPE & CONDITION

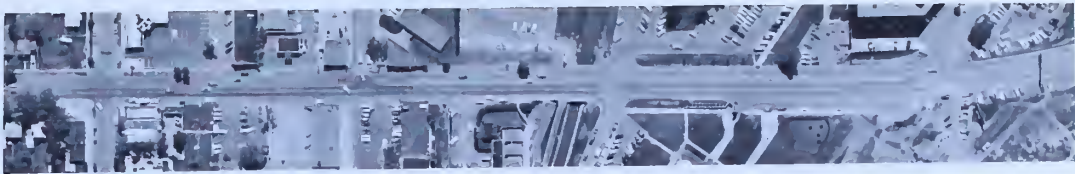


ACCIDENT SUMMARY 1965 THRU 1968

ANGLE	4
HEAD-ON	
REAR-END	4
SIDESWIPE	
TURNING	8
PARKING	
FIXED OBJECT	
PEDESTRIAN	
BACKING	
MISC.	
TOTAL	16

SPEED & DELAY





EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE



COSTS

		FOR COST OF NEW SIGNALS SEE PAGE 105
PAVEMENT MARKING & SIGNS		
\$1,000		
		FOR COST OF NEW SIGNALS SEE PAGE 105

BILLINGS TOPICS

CLASSIFICATION

Minor Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

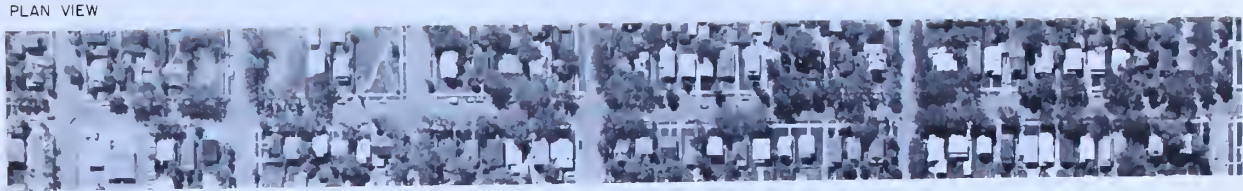
50'
BIT. CONCRETE
GOOD

ACCIDENT SUMMARY 1969 THRU 1971

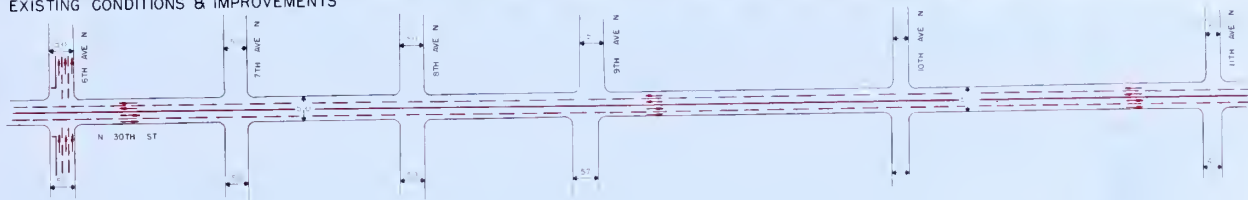
6	ANGLE			3					
2	HEAD-ON								
3	REAR-END								
1	SIDE SWIPE								
7	TURNING								
1	PARKING								
1	FIXED OBJECT								
1	PEDESTRIAN								
1	BACKING								
1	MISC.								
TOTAL 21				3		3			4

SPEED & DELAY

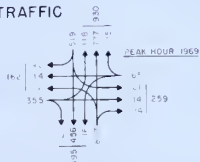
40	
30	
20	
10	
0	
25	
20	
15	
10	
5	
0	



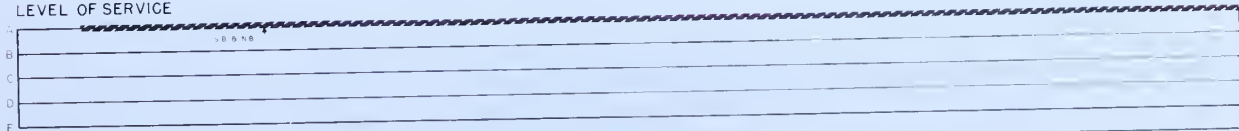
EXISTING CONDITIONS & IMPROVEMENTS



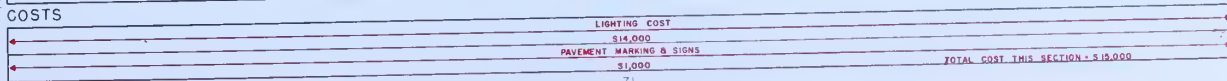
TRAFFIC



LEVEL OF SERVICE



COSTS



BILLINGS TOPICS

CLASSIFICATION

Minor Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

50'	
BIT. CONCRETE	
GOOD	

ACCIDENT SUMMARY 1969 THRU 1971

ANGLE	1	1	
HEAD-ON		1	2
REAR-END	1		
SIDESWIRE		1	2
TURNING	2		
PARKING			2
FIXED OBJECT	1		
PEDESTRIAN			
BACKING			
MISC.	5	3	6
TOTAL			

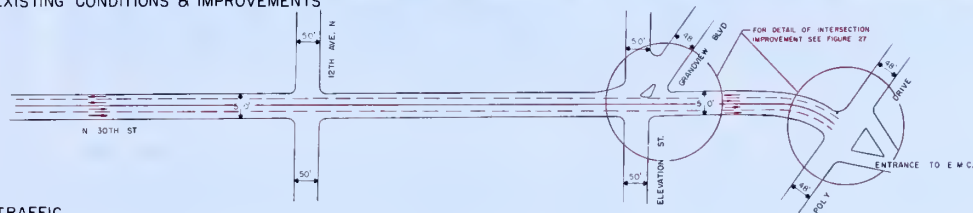
SPEED & DELAY

40	
30	
20	
10	
0	
25	
20	
15	
10	
5	
0	

PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

A	50' 0" NB	
B		
C		
D		
E		

COSTS

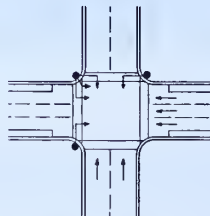
LIGHTING COST	\$ 6,000	COST TO IMPROVE TWO INTERSECTIONS	\$ 7,500
PAVEMENT MARKING & SIGNS	\$ 400	TOTAL COST THIS SECTION	\$ 13,900

AREA I COST SUMMARY

Location	Intersection Type		Cost
	Type	Number	
Montana Avenue-1st Avenue North	Type A	7	\$80,500
Implement One Way Couplet	B	4	25,300
including modernization of signals	C	10	4,300
	D	13	5,350
	Misc.		2,900
TOTAL COST			\$128,550
2nd Avenue North-3rd Avenue North			
Implement One Way Couplet	Type A	2	\$ 23,000
including modernization of signals	B	4	25,300
	C	10	3,500
	D	6	2,100
	Misc.		1,500
TOTAL COST			\$ 55,400
4th Avenue North-6th Avenue North			
Couplet Improvements including	Type A	7	\$ 82,800
modernization of signal system	B	6	79,100
	C	4	1,400
	D	10	3,500
	Misc.		3,300
TOTAL COST			\$170,100
Division Street-North-South couplets	Costs included above		
North 27th Street			
Provide for four-lane Operation	Widening-misc.		\$ 79,500
North 30th Street			
Upgrade street to Arterial	Lighting Inter-		
Status	section improvement,		
	Misc.		\$ 30,900
SUBTOTAL			\$464,450
PLUS 15% Engineering & Contingencies			69,668
ESTIMATED TOTAL COST -- AREA I			\$534,118

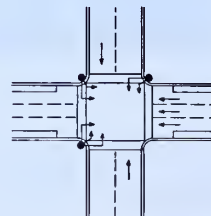
TYPICAL INTERSECTION SITUATIONS FOR COST PURPOSES

TYPE-A



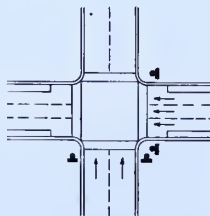
ONE WAY-ONE WAY
SIGNALIZED

TYPE-B



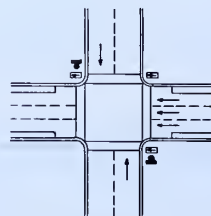
ONE WAY-TWO WAY
SIGNALIZED

TYPE-C



ONE WAY-ONE WAY
SIGNED

TYPE-D



ONE WAY-TWO WAY
SIGNED

Type E = Two way - Two way signalized

AREA II - NORTHWEST CORRIDOR

Two arterials serve this area in an east-west direction. Rimrock Road is on the Federal Aid Secondary System and carries the higher volume of traffic since it provides a through connection to the rural area west of Billings and also junctions with Zimmerman Trail. Poly Drive, which has been designated as part of the TOPICS System, is a minor arterial and serves primarily the residential area.

Traffic volumes on both streets range from approximately 5,000 ADT near North 27th Street to less than half that amount near the west boundary of the urban area on Rimrock Road and to approximately 1,500 ADT near the west end of Poly Drive. With a few minor exceptions, both streets are functioning without undue traffic delay and any areas of concern are located near the high volume east end.

Rimrock Road - North 27th Street Intersection

Problem - The increase in traffic volumes on Rimrock Road during the past few years indicates that volume warrants may be adequate for signalization.

Capacity - Capacity is presently adequate although left turning volumes off of North 27th Street are experiencing some long delays due to the relative high speed of traffic descending the rimrocks from the airport. The fact that the grade on North 27th Street exceeds 7% also compounds the problem during snowy or icy conditions.

Accidents - The intersection has been averaging ten accidents per year for the past three years. More than 50% of the accidents have involved turning movements and two-thirds of the turning movement accidents have occurred during the winter months.

Recommended Improvements - A new signal installation is recommended with provisions for left turn refuge on North 27th Street.

Evaluation - Since it appears that traffic volumes will continue to

increase at this intersection, signals should help to alleviate the accident problem. Special consideration will have to be given to the stopping distance on North 27th Street due to the high approach speeds and the extreme grade.

Poly Drive - Grandview Boulevard and North 30th Street Intersection

Problem - Improvements to these two intersections are based upon the attraction of traffic to the North 30th Street arterial as discussed previously under Area I. The improvements are to expedite the movement of traffic between North 30th Street and the Poly Drive-Grandview Boulevard couplet. The couplet has been previously recommended in the transportation study.

Capacity - No capacity problems presently exist or are contemplated in the near future at either intersection.

Accidents - No serious accident problem presently exists at either intersection.

Recommended Improvements - Improvements are limited to the minor channelization as indicated by Figure 27.

Evaluation - As noted above, the improvements at the two locations are to provide for an efficient flow of traffic from North 30th Street to the one-way couplet system. No history of accidents or capacity problems are presently available, however, the channelization should aid the traffic in selecting the proper traffic lane and lessen the chance of collisions.

Poly Drive-Grandview Boulevard and Virginia Lane Intersection

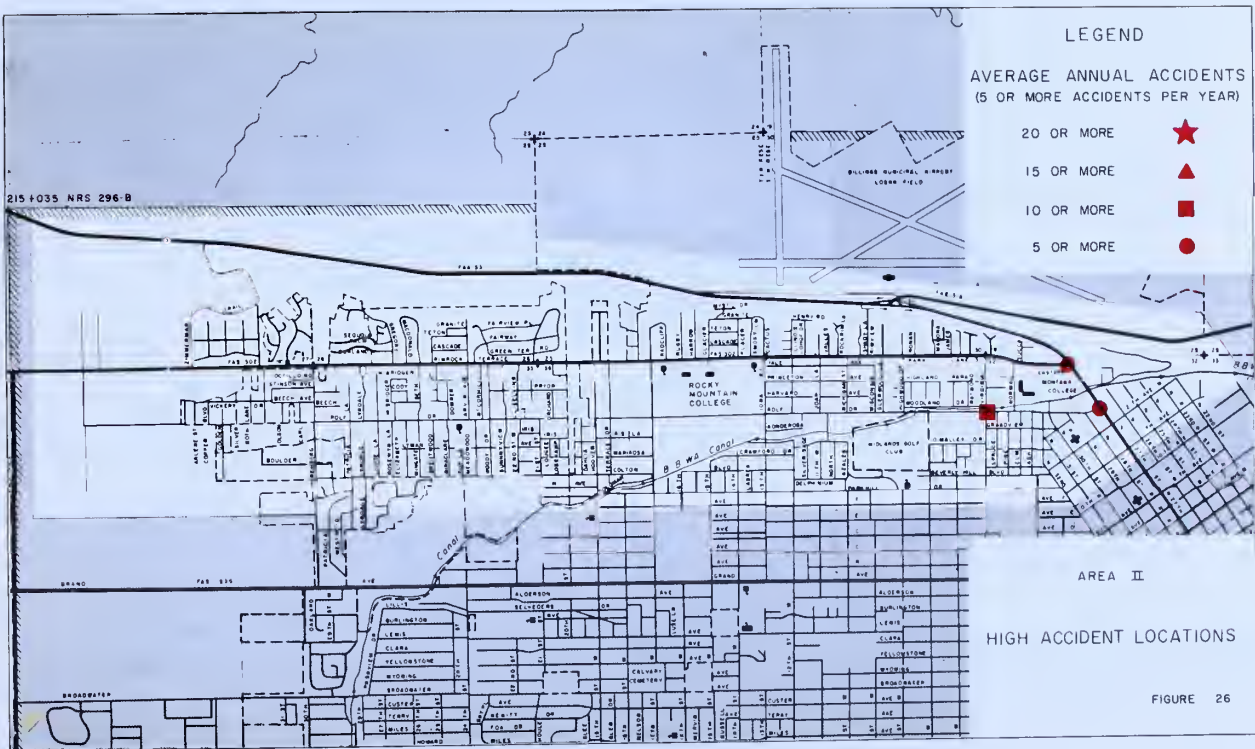
Problem - Although signalized, this intersection has a history of accidents that indicates the signals are not effectively doing the job intended. The intersection is also the west terminus of the Poly Drive-Grandview Boulevard couplet which has placed more importance on the intersection due to the anticipated increase in traffic volumes.

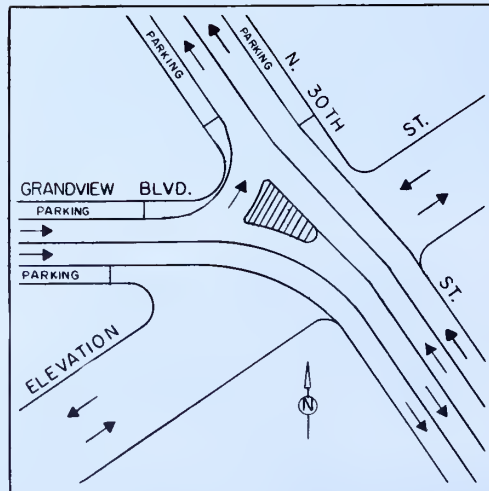
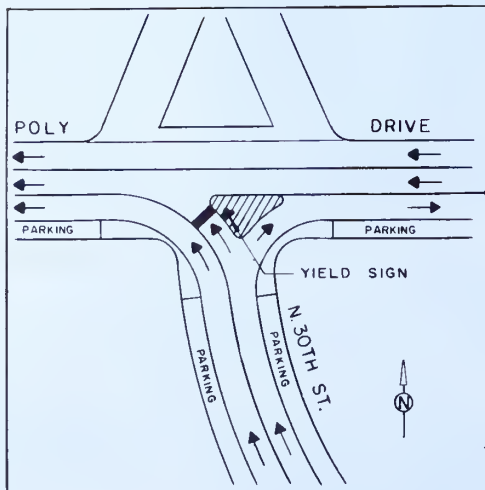
Capacity - The intersection has not experienced any great capacity problems in the past, but with the implementation of North 30th Street as a major arterial feeding into the Poly Drive-Grandview Boulevard couplet and the recent improvements to Poly Drive west of the intersection, it is anticipated that volumes will increase considerably. The planned improvement will increase the capabilities of the intersection approximately 30 percent.

Accidents - Of the 42 accidents reported over a four year period, 52 percent are right angle collisions indicating an inadequacy of the present signals and geometrics. The recommended improvement should greatly reduce the accident potential.

Recommended Improvements - Since warrants for signals are present and due to the poor geometrics of the existing intersection, it is proposed that the signals be updated making provisions for the one-way couplet and also including an all-red clearance interval that will prevent cross traffic from entering the intersection until other movements have cleared. The design should also incorporate provisions for the leading left turn as depicted on Figure 28.

Evaluation - These improvements will increase the capacity an estimated 30 percent and provide a safer terminus for the one-way couplet. Accidents are expected to decrease approximately 40-50 percent by eliminating the simultaneous movement of traffic that can now occur under existing conditions.



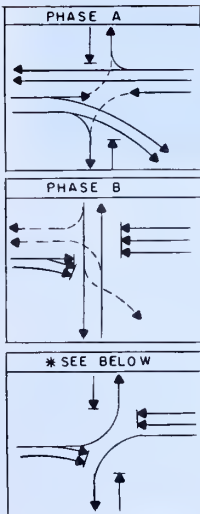


AREA II

INTERSECTION IMPROVEMENT

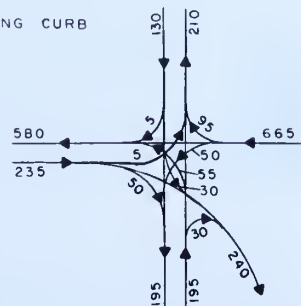
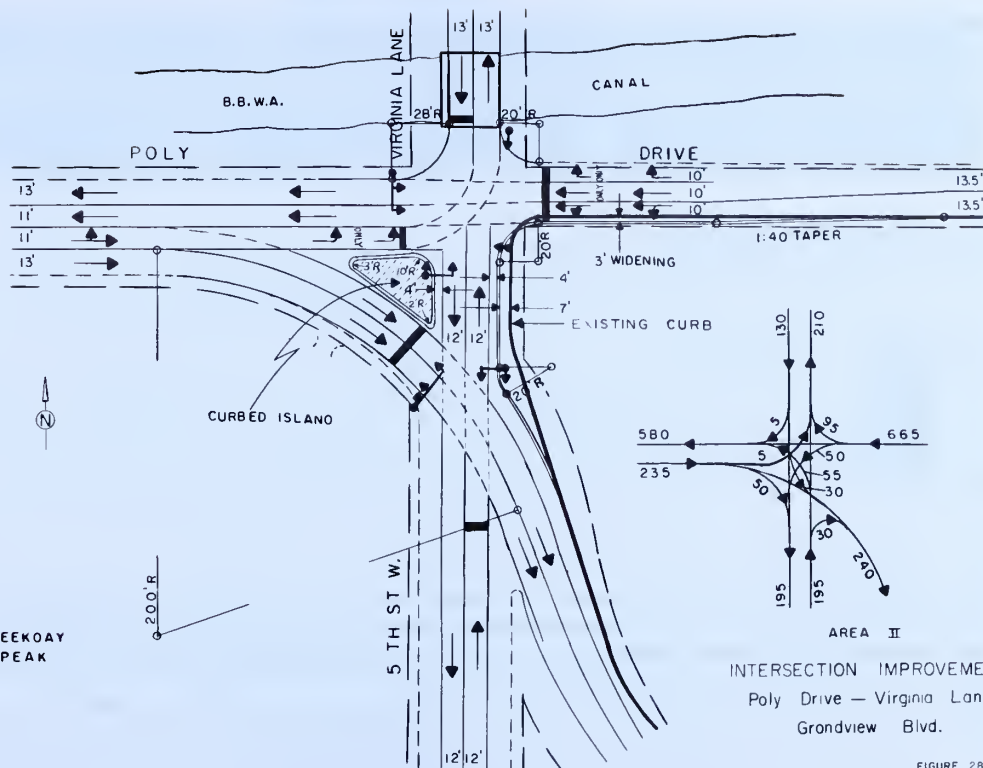
N. 30th St - Poly Drive

N. 30th St. - Grandview Blvd.



*OPTIONAL LEADING
LEFT TURN - ϕA

AVERAGE WEEKDAY
EVENING PEAK
1971



INTERSECTION IMPROVEMENT
Poly Drive — Virginia Lane
Grandview Blvd.

BILLINGS TOPICS

CLASSIFICATION

Minor Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

35'
BIT CONCRETE
FAIR

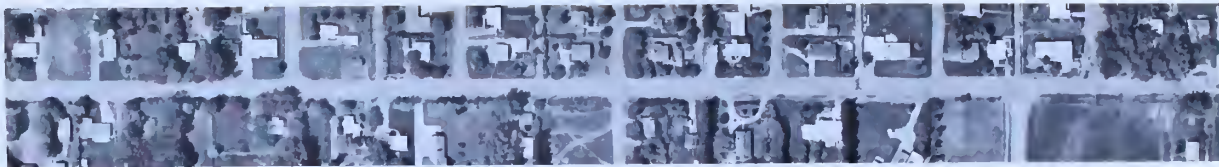
ACCIDENT SUMMARY 1969 THRU 1971

ANGLE		
HEAD-ON		
REAR-END		
SIDE SWIPE		
TURNING		
PARKING		
FIXED OBJECT		
PEDESTRIAN		
BACKING		
MISC.		
TOTAL		

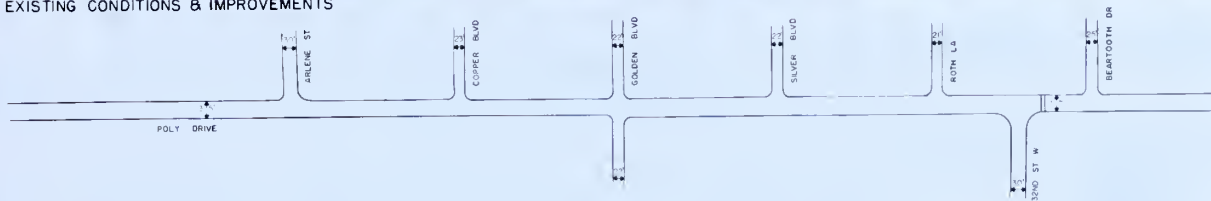
SPEED & DELAY

40	
30	
20	
10	
0	
23	
20	
15	
10	
5	
0	

PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

A	
B	WB
C	EB
D	
E	

COSTS

BILLINGS TOPICS

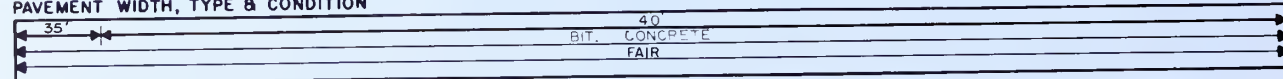
CLASSIFICATION

Minor Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

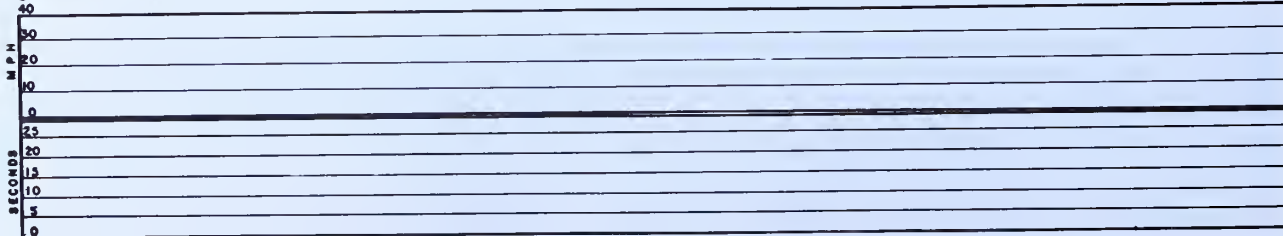


ACCIDENT SUMMARY 1969 THRU 1971

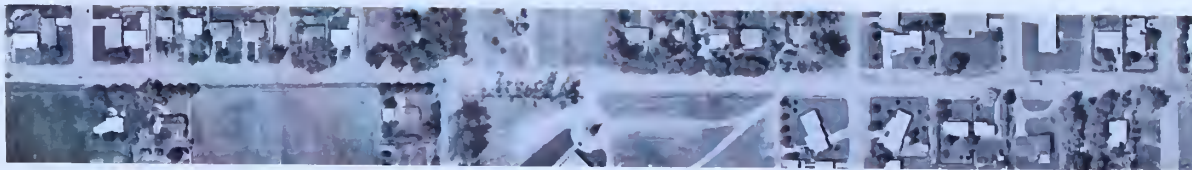
ANGLE	5				
HEAD-ON	1				
REAR-END	1				
SIDE SWIPE					
TURNING	1				
PARKING					
FIXED OBJECT					
PEDESTRIAN					
BACKING					
MISC.	7				
TOTAL	14				

(69-71)

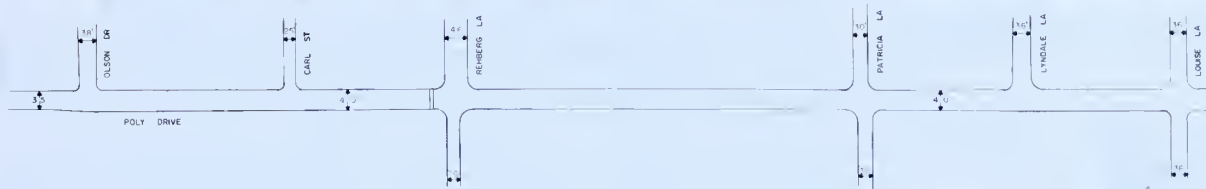
SPEED & DELAY



PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

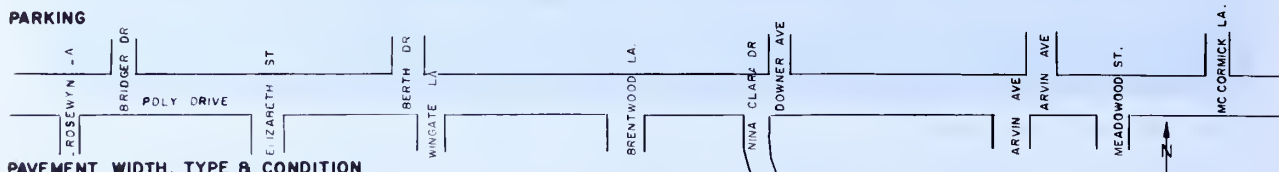
A	WB	EB B&WB
B	WB	EB
C		
D		
E		

COSTS

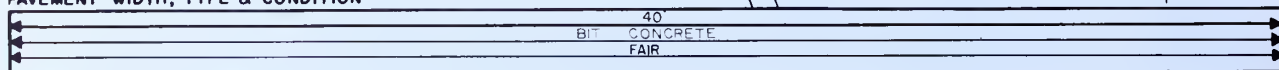
CLASSIFICATION

Minar Arterial

PARKING



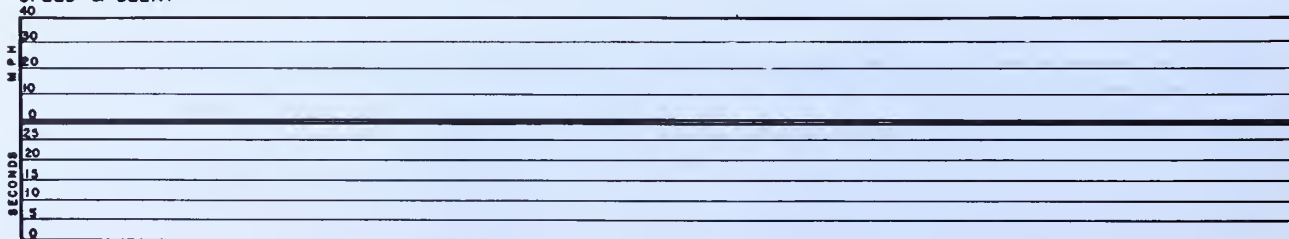
PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1969 THRU 1971

[illegible]

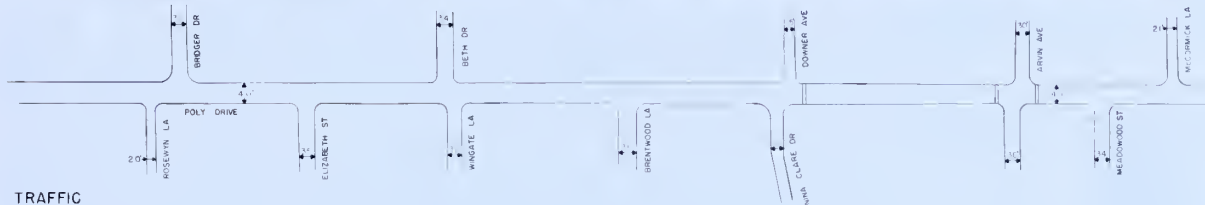
SPEED & DELAY



PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

A	
F	1.0 BWO 1.0
C	0.0
D	
E	

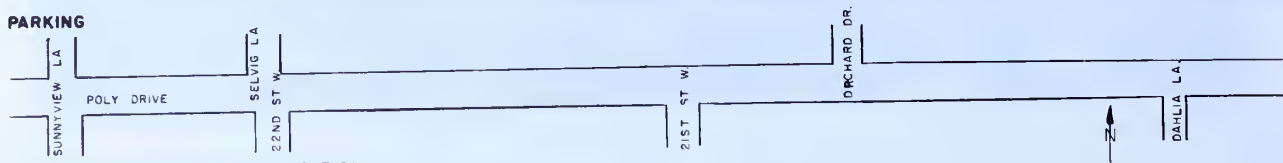
COSTS

BILLINGS TOPICS

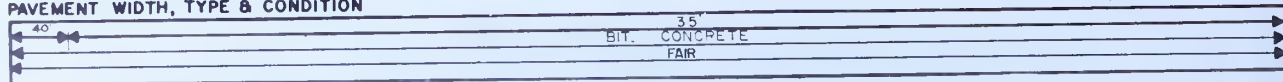
CLASSIFICATION

Minor Arterial

PARKING



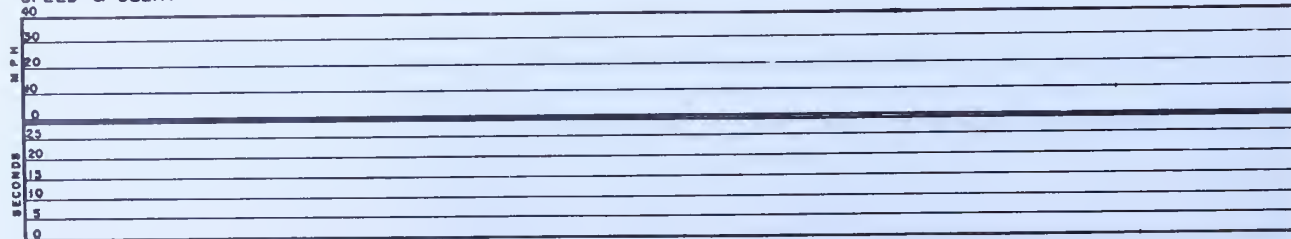
PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1969 THRU 1971

ACCIDENT SUMMARY 1969 THRU 1971					
		ANGLE			1
		HEAD-ON			
		REAR-END			
		SIDE SWIPE			
		TURNING			1
		PARKING			
		FIXED OBJECT	1		
		PEDESTRIAN			
		BACKING			
		MISC.			
TOTAL					2

SPEED & DELAY



PLAN VIEW

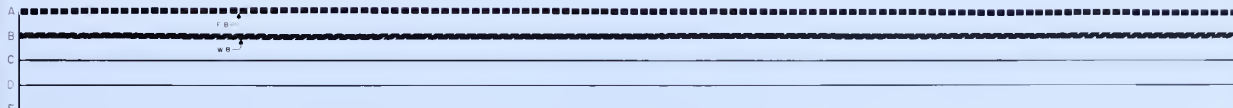


EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE



COSTS

CLASSIFICATION

Minor Arterial

PARKING



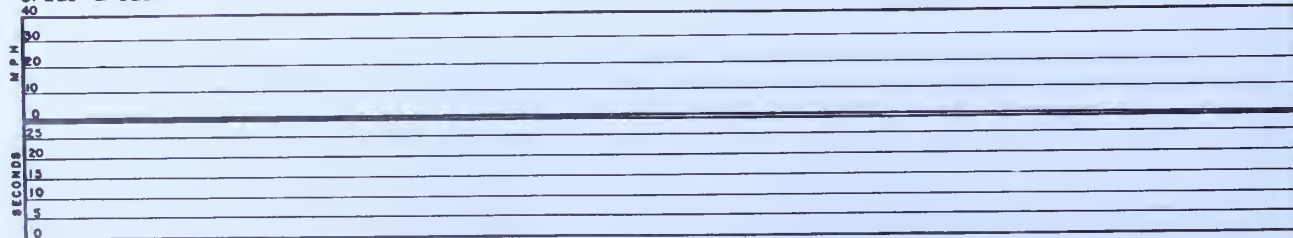
PAVEMENT WIDTH, TYPE & CONDITION



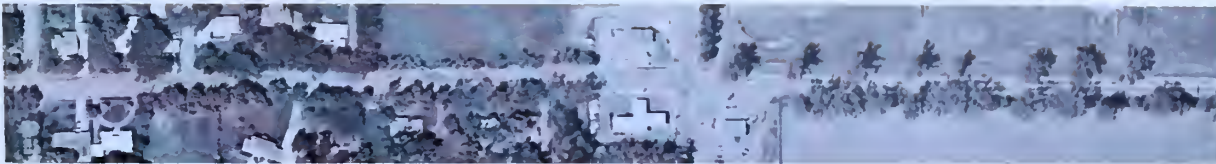
ACCIDENT SUMMARY 1969 THRU 1971

	ANGLE		2
	HEAD-ON		7
	REAR-END		
1	SIDE SWIPE		3
1	TURNING	2	3
	PARKING		3
	FIXED OBJECT		
	PEDESTRIAN		
	BACKING		
	MISC.		13
TOTAL	2	2	

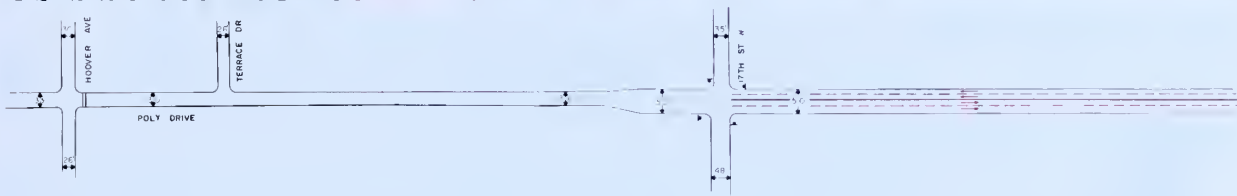
SPEED & DELAY



PLAN VIEW

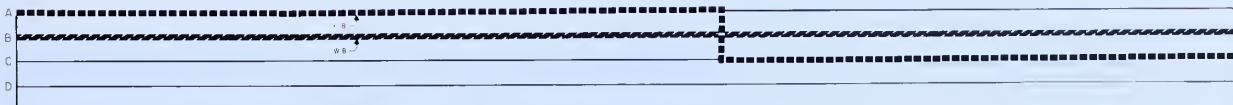


EXISTING CONDITIONS & IMPROVEMENTS SHOWN IN RED



TRAFFIC

LEVEL OF SERVICE



COSTS

BILLINGS TOPICS

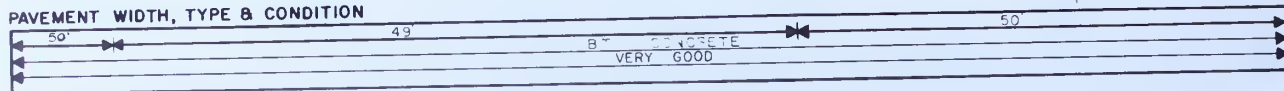
CLASSIFICATION

Minor Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION



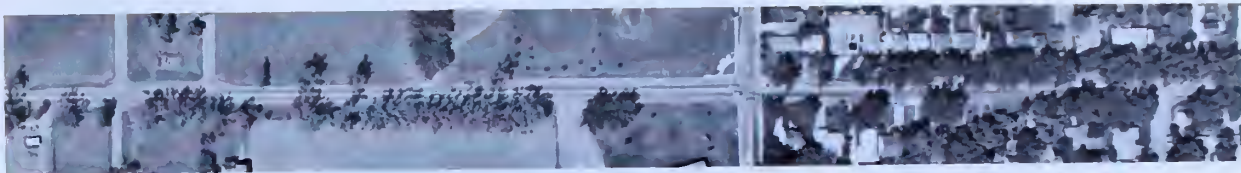
ACCIDENT SUMMARY 1969 THRU 1971

ANGLE	4		
HEAD-ON	1		
REAR-END	4		
SIDEWIDE	2	1	
TURNING	2		
PARKING			
FIXED OBJECT			
PEDESTRIAN			
BACKING			
MISC.	13	1	
TOTAL	(69-71)		

SPEED & DELAY

40	
30	
20	
10	
0	
25	
20	
15	
10	
5	
0	

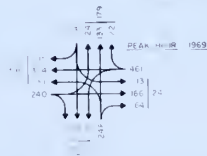
PLAN VIEW



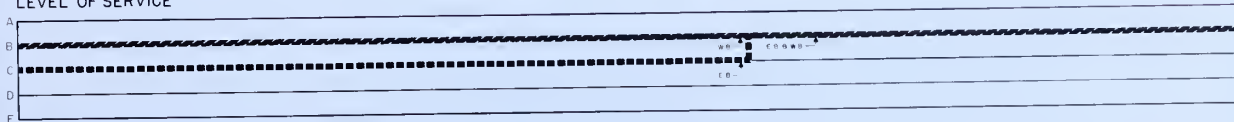
EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE



COSTS



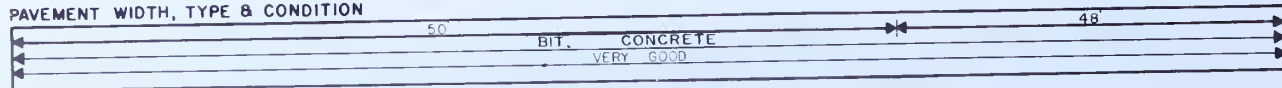
CLASSIFICATION

Minor Arteriol

PARKING



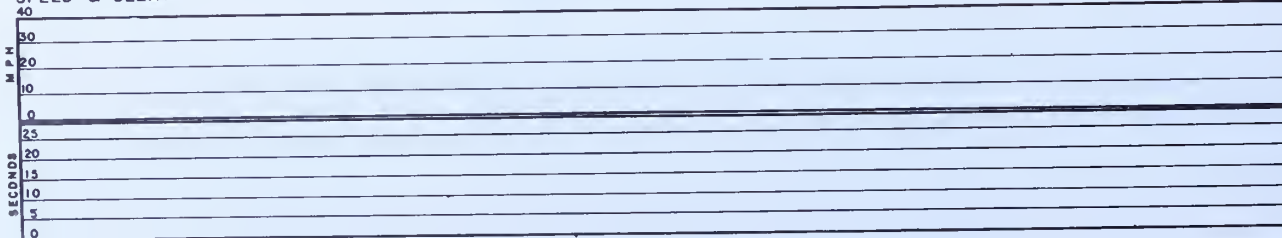
PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1969 THRU 1971

ACCIDENT SUMMARY 1969 THRU 1971									
ANGLE									
HEAD-ON									
REAR-END			2						
SIDE SWIPE									
TURNING									
PARKING									
FIXED OBJECT			1						
PEDESTRIAN									
BACKING						1			
MISC.								1	
TOTAL			3			4		1	

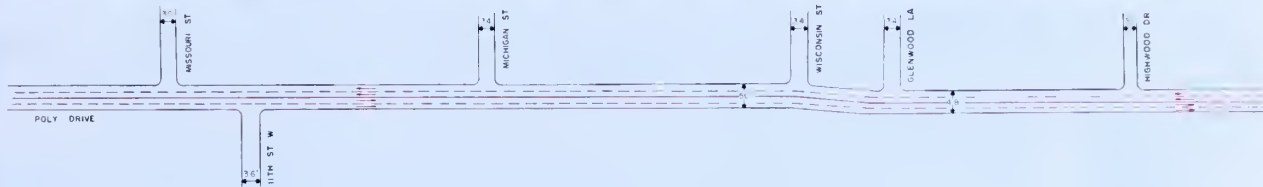
SPEED & DELAY



PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

A	
B	
C	
D	
E	

COSTS

BILLINGS TOPICS

NO PARKING

CLASSIFICATION

Minor Arterial

PARKING

POLY DRIVE

PAVEMENT WIDTH, TYPE & CONDITION

48'

BIT. CONCRETE
VERY GOOD

36'

48'

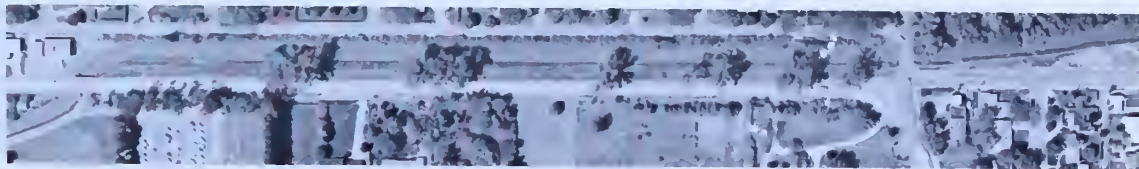
ACCIDENT SUMMARY 1969 THRU 1971

ANGLE	9
HEAD-ON	6
REAR-END	1
SIDE-SWIP	2
TURNING	
PARKING	
FIXED OBJECT	
PEDESTRIAN	
BACKING	
MISC.	
TOTAL	18

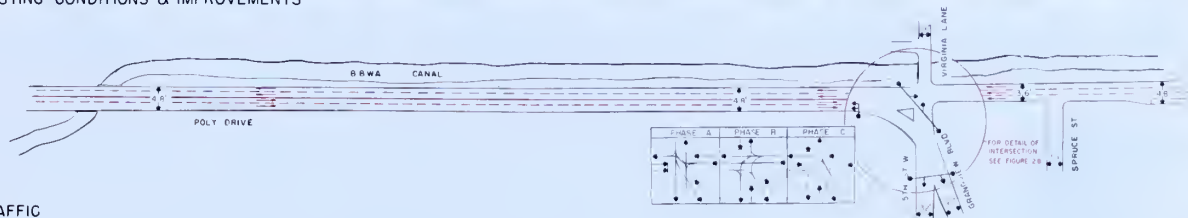
(69-71)

SPEED & DELAY

40	
30	
20	
10	
0	
23	
20	
15	
10	
5	
0	

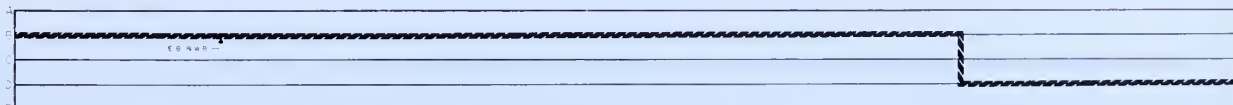


EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE



COSTS

PAVEMENT MARKING TO IMPLEMENT 4-LANE TRAFFIC ON POLY DRIVE FROM VIRGINIA LANE TO 17TH ST W	
\$4,000	\$45,000
TOTAL COST THIS SECTION = \$49,000	

LEGEND

NO PARKING

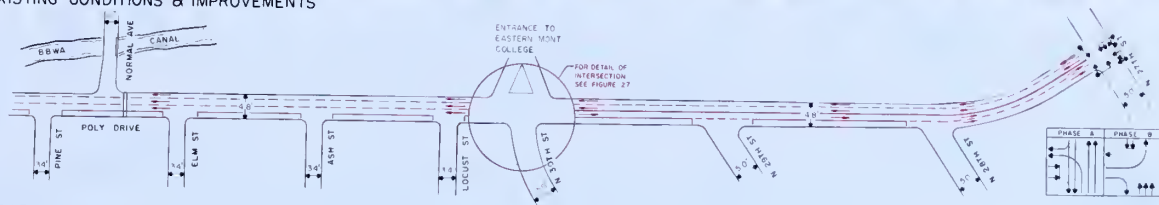
PAVEMENT WIDTH, TYPE & CONDITION

Width	Type	Condition
48'	BIT. CONCRETE	VERY GOOD

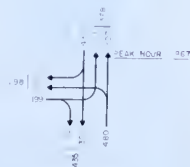
[illegible]



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE

A	
B	
C	
D	
E	

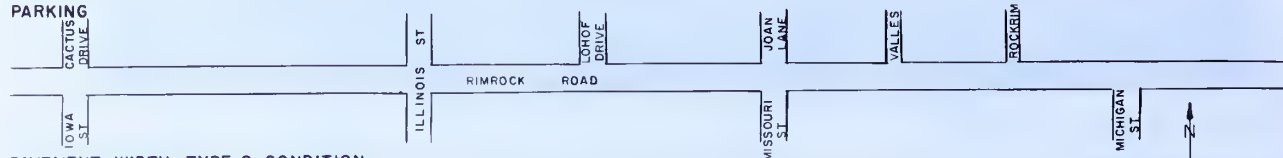
COSTS

BILLINGS TOPICS

CLASSIFICATION

Principal Arterial

PARKING



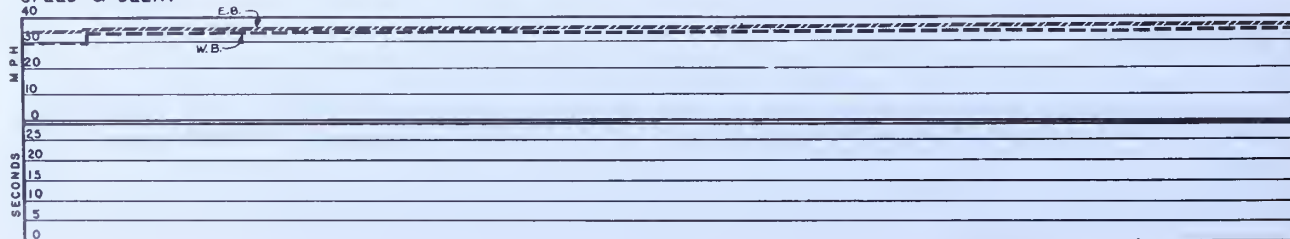
PAVEMENT WIDTH, TYPE & CONDITION

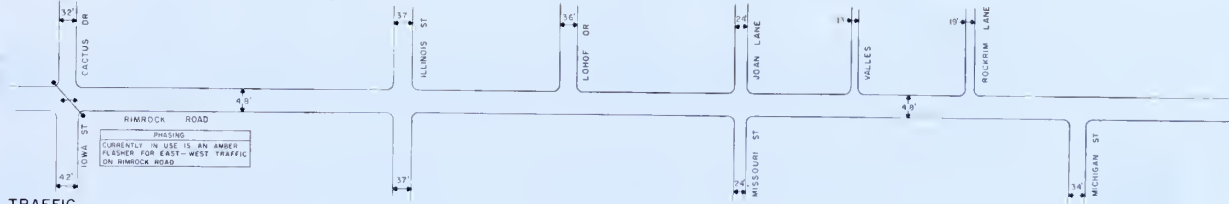
48
BIT. CONCRETE
GOOD

ACCIDENT SUMMARY 1965 THRU 1968

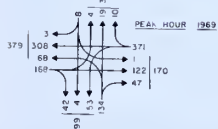
ANGLE	
HEAD-ON	
REAR-END	
SIDE SWIPE	
TURNING	
PARKING	
FIXED OBJECT	
PEDESTRIAN	
BACKING	
MISC.	
TOTAL	

SPEED & DELAY





TRAFFIC



LEVEL OF SERVICE

A diagram of a multi-layered structure. The layers are labeled A through F from top to bottom. Layer A is the topmost layer, followed by B, C, D, and E. Layer F is the bottommost layer. A dashed line labeled 'CENWB' is shown within layer B. The layers are separated by horizontal lines, and the entire structure is enclosed in a rectangular frame.

COSTS

BILLINGS TOPICS

CLASSIFICATION

Principal Arterial

PARKING

SHADY LN

RIMVIEW DR

UPPER HIGHWOOD DRIVE

RONAN DR

MACONA

JAMES ST

GLENWOOD LAKE

RIMROCK ROAD

HIGHWOOD DRIVE

N

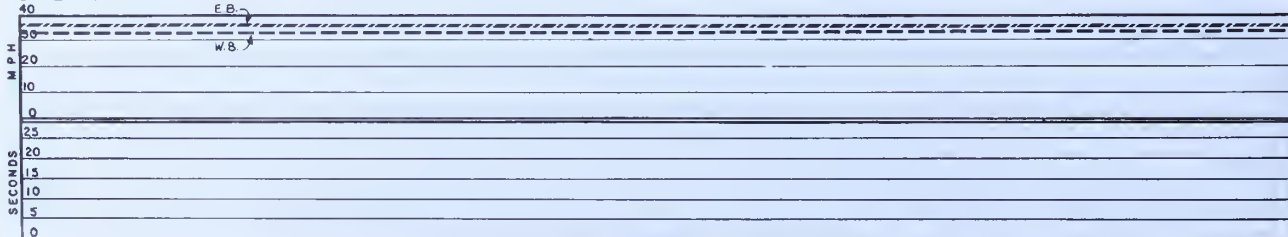
PAVEMENT WIDTH, TYPE & CONDITION

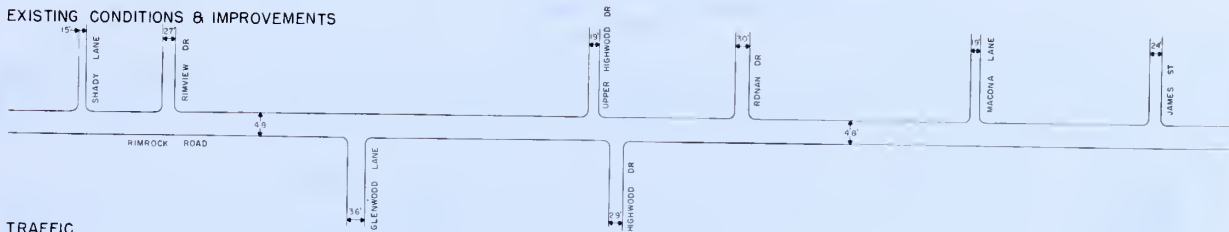
48
BIT. CONCRETE
GOOD

ACCIDENT SUMMARY 1965 THRU 1968

ANGLE	
HEAD-ON	
REAR-END	
SIDE SWIPE	
TURNING	
PARKING	
FIXED OBJECT	
PEDESTRIAN	
BACKING	
MISC.	
TOTAL	

SPEED & DELAY





TRAFFIC

LEVEL OF SERVICE

B
 F
 U
 E

E, P, Q, W, B

COSTS

BILLINGS TOPICS

LEGEND

CLASSIFICATION

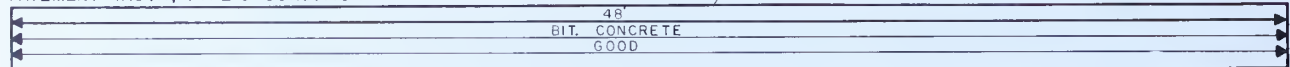
Principal Arterial

NO PARKING

PARKING



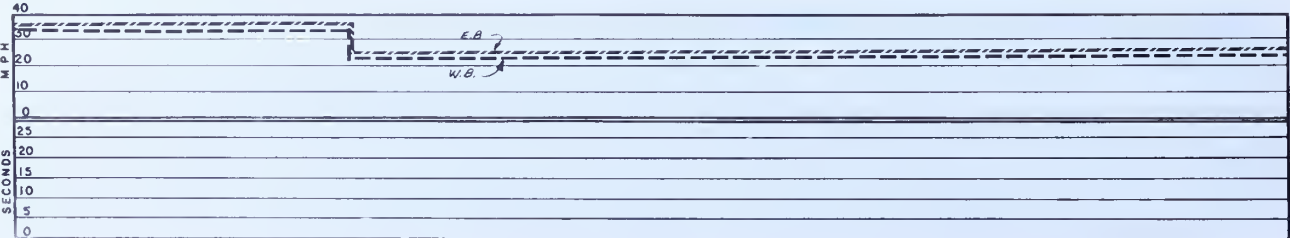
PAVEMENT WIDTH, TYPE & CONDITION



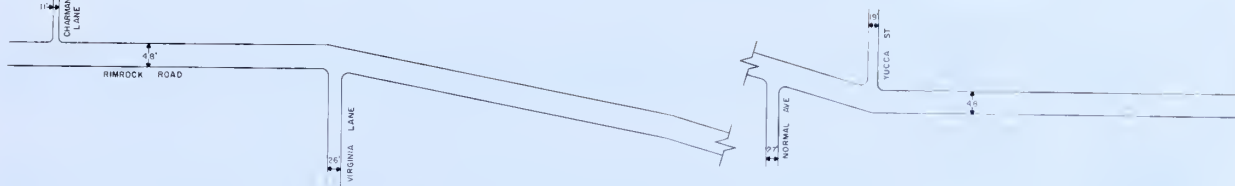
ACCIDENT SUMMARY 1965 THRU 1968

ANGLE			
HEAD-ON			
REAR-END	2		1
SIDE-SWipe			
TURNING			
PARKING			
FIXED OBJECT			
PEDESTRIAN			
BACKING	1		1
MISC.			
TOTAL	3		2

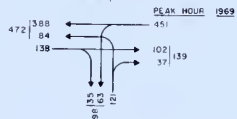
SPEED & DELAY



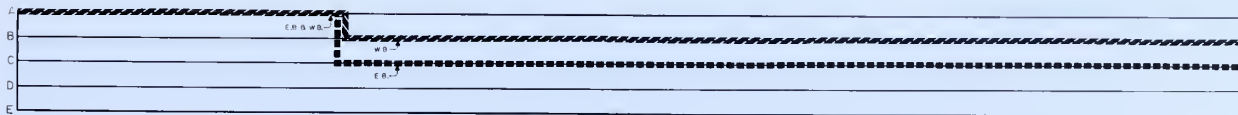
EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



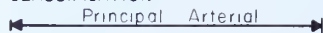
LEVEL OF SERVICE



COSTS

BILLINGS TOPICS

CLASSIFICATION



PARKING



PAVEMENT WIDTH, TYPE & CONDITION

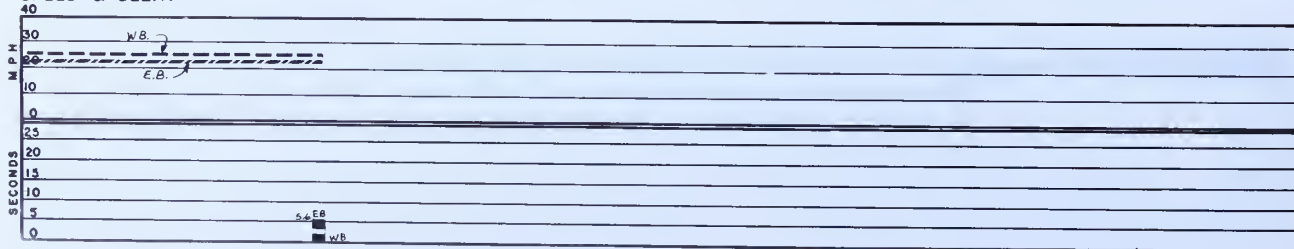
48	
BIT. CONCRETE	
GOOD	

ACCIDENT SUMMARY 1965 THRU 1968

ANGLE	
HEAD-ON	1
REAR-END	0
SIDE-SWIPE	
TURNING	16
PARKING	
FIXED OBJECT	5
PEDESTRIAN	
BACKING	
MISC.	
TOTAL	30

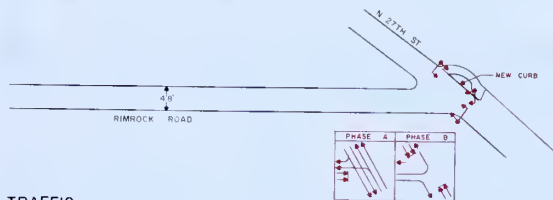
(69-71)

SPEED & DELAY



PLAN VIEW

EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

A	
B	
C	
D	
E	

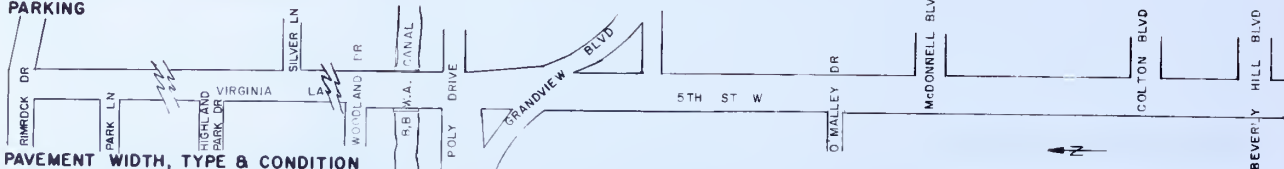
COSTS

	NEW SIGNALS \$20,000
	TOTAL COST THIS SECTION = \$20,000

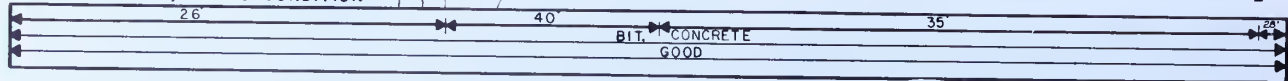
CLASSIFICATION

Minor Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

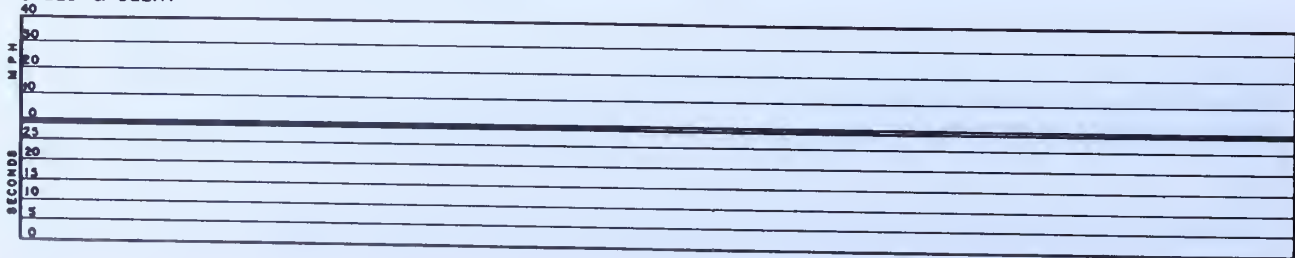


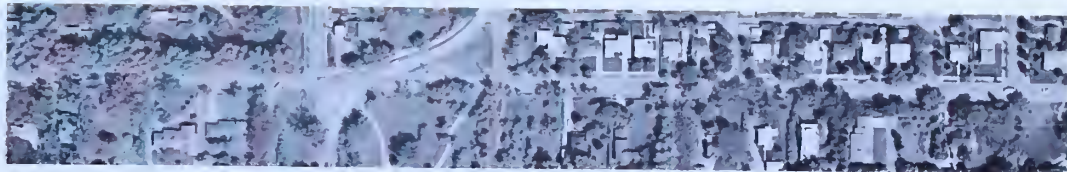
ACCIDENT SUMMARY 1969 THRU 1971

[illegible]

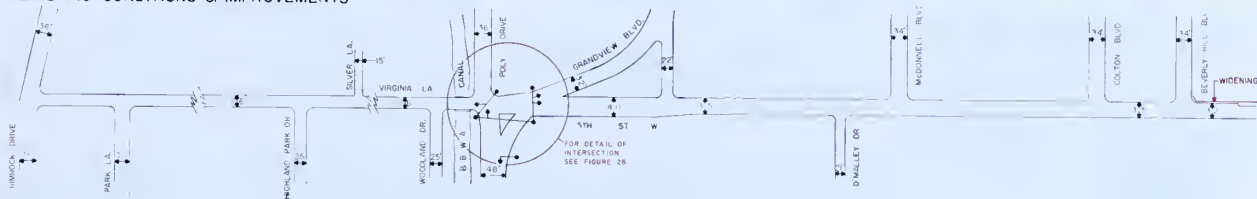
6-1-69 TO 9-30-71

SPEED & DELAY

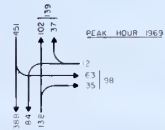




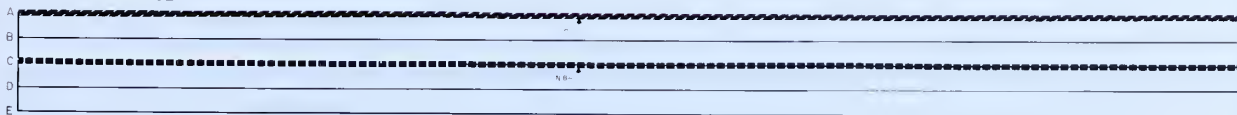
EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE



COSTS

FOR COST SEE PAGE 95		COST \$100 WIDENING IS ON PAGE 102
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BILLINGS TOPICS

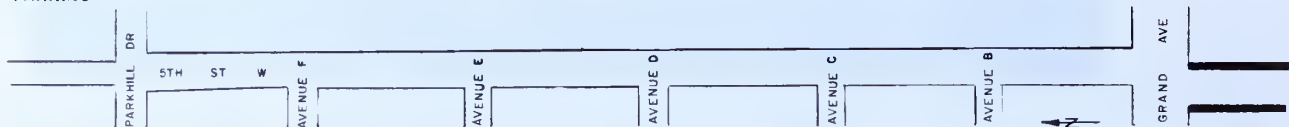
LEGEND

CLASSIFICATION

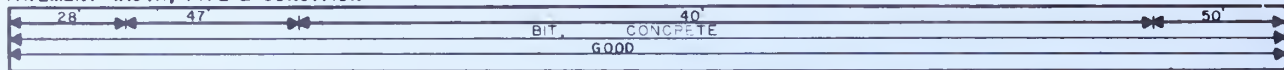
NO PARKING

Minor Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

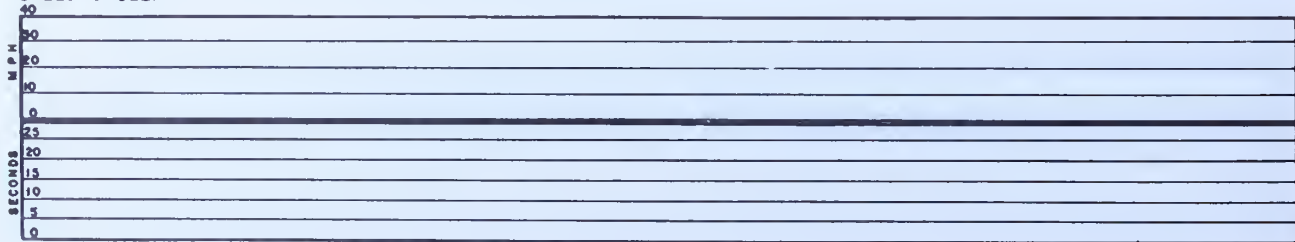


ACCIDENT SUMMARY 1969 THRU 1971

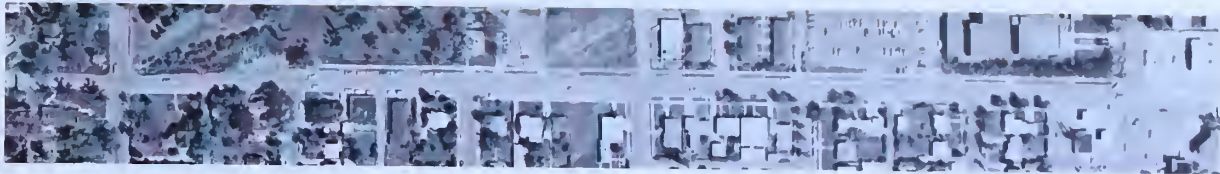
	ANGLE	HEAD-ON	REAR-END	SIDESWIP	TURNING	PARKING	FIXED OBJECT	PEDESTRIAN	BACKING	MISC.
1										3
2										10
3										3
4										13
5										2
6										
7										
8										
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90										
91										
92										
93										
94										
95										
96										
97										
98										
99										
100										
TOTAL	5									31

6-1-69 TO 9-30-71

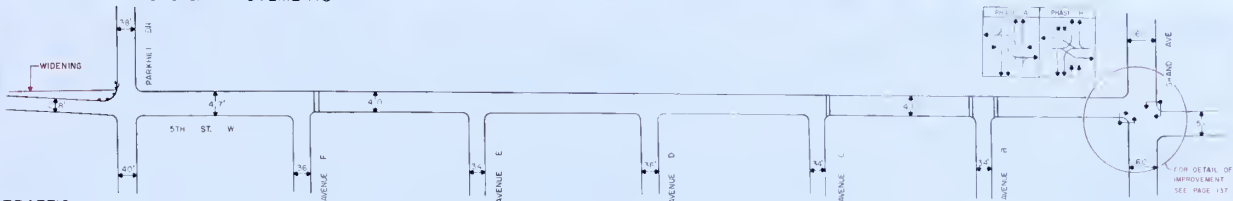
SPEED & DELAY



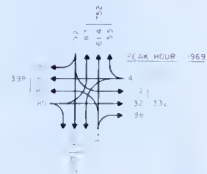
PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE



COSTS

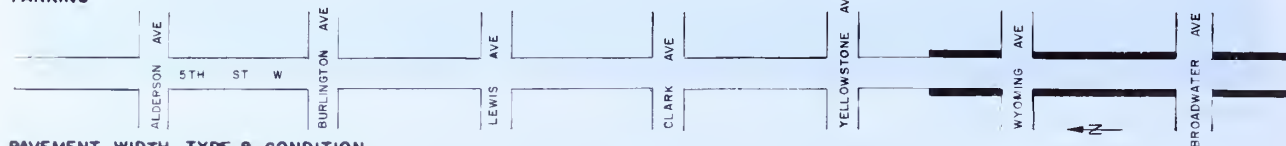
WIDENING - PARKHILL DR TO BEVERLY HILL BLVD.	FOR COST SEE PAGE 137
\$ 30,000	
TOTAL COST THIS SECTION	\$ 30,000

CLASSIFICATION

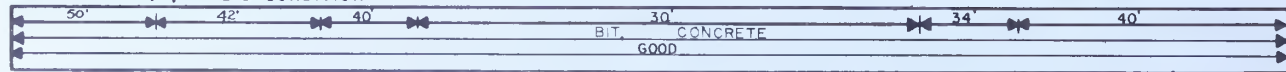
NO PARKING

Minor Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1969 THRU 1971

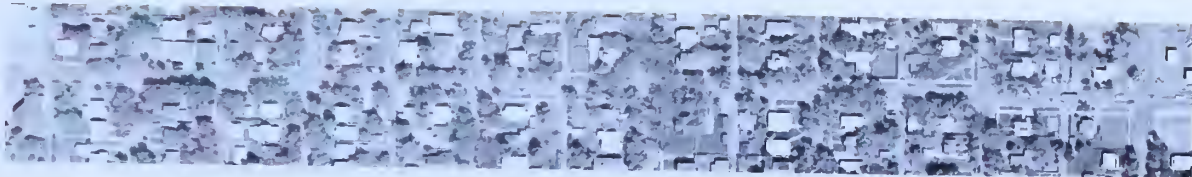
ANGLE	1			5		1		3
HEAD-ON								
REAR-END				5	1			4
SIDE-SWipe								1
TURNING	1				1			6
PARKING			1					
FIXED OBJECT				1		2		1
PEDESTRIAN								
BACKING								
MISC				1				
TOTAL	2	1	1	12	2	3		15

6-1-69 TO 9-30-71

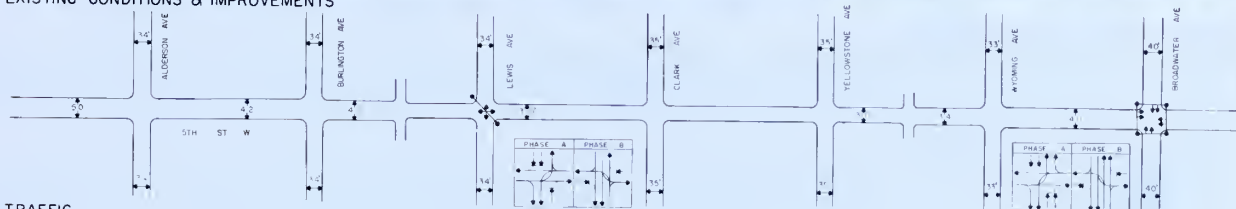
SPEED & DELAY

30	
20	
10	
0	
SECONDS	
30	
20	
10	
0	

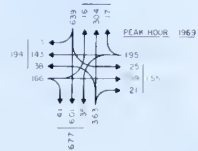
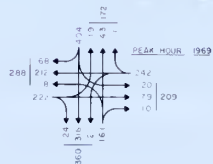
PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE

A	
B	
C	
D	
E	

COSTS

Minor Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

40'
BT. CONCRETE
GOOD

ACCIDENT SUMMARY 1969 THRU 1971

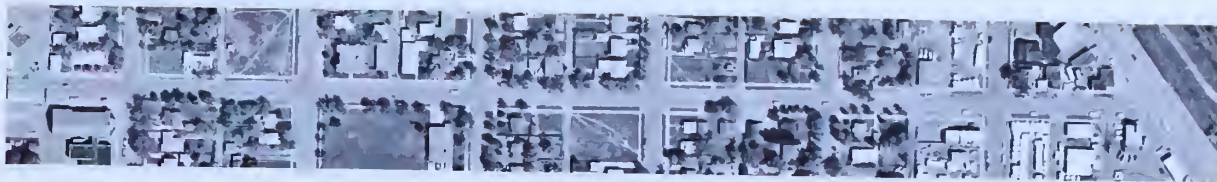
ANGLE		1	1		1	1
HEAD-ON						
REAR-END						3
SIDE-SWIFT						
TURNING					3	1
PARKING						
FIXED OBJECT					1	
PEDESTRIAN						1
BACKING						
MISC.						
TOTAL		3	1		6	7

6-1-69 TO 9-30-71

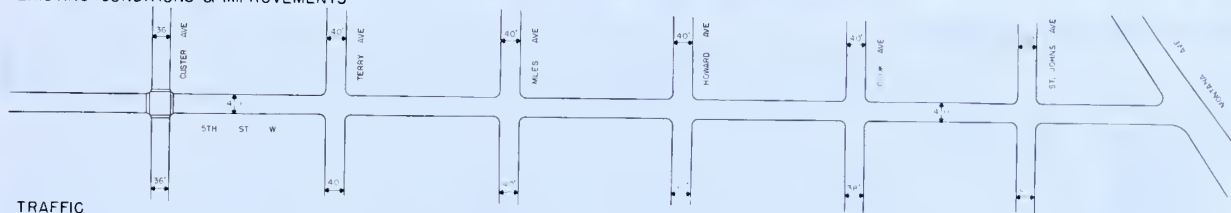
SPEED & DELAY



PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

A	
B	
C	
D	
E	

COSTS

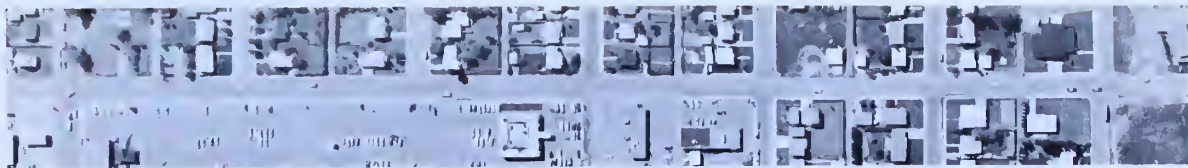
NO PARKING

Principali Arteriali

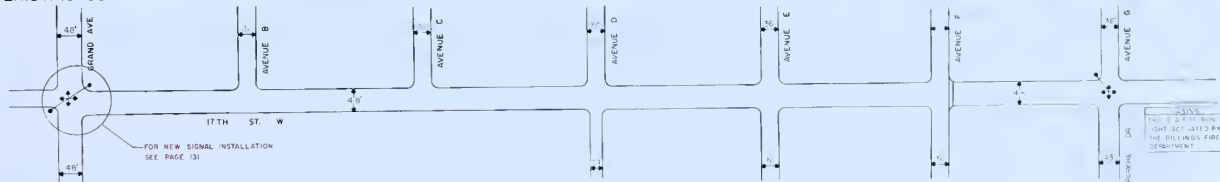
48'
BIT CONCRETE
GOOD

	9	ANGLE	1							1		1
	11	HEAD-ON				1						
		REAR-END	1	2		1		1				1
	1	SIDE SWIPE		2								
	7	TURNING		1		2		1				2
	1	PARKING										
		FIXED OBJECT				1						
	1	PEDESTRIAN										
		BACKING										
		MISC.				1						
TOTAL	30		2	5		6		2		1		4

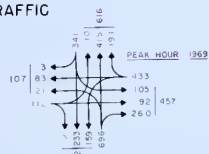
PLAN VIEW



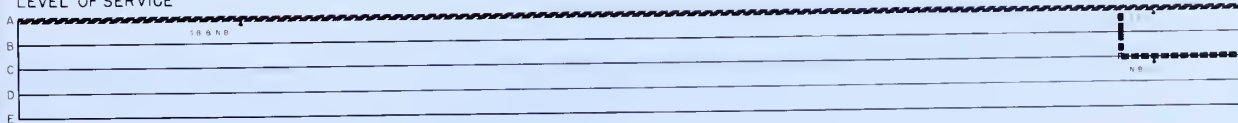
EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE



COSTS

		SIGN - FIRE RUN LIGHT
		\$ 300
		TOTAL COST THIS SECTION: \$ 300

NO PARKING

The map shows a horizontal line representing the 'Principal Arterial'. Below this line, from left to right, are the following features: a 'PARKING' area, a 'CANAL' (indicated by a wavy line), '17TH ST W', 'COLTON BLVD', 'MARIPOSA LA', 'IRIS LA', 'POLY DRIVE', a 'RAILROAD' (indicated by a wavy line), and 'BRIMROCK ROAD'. A north arrow points upwards, labeled 'N'.

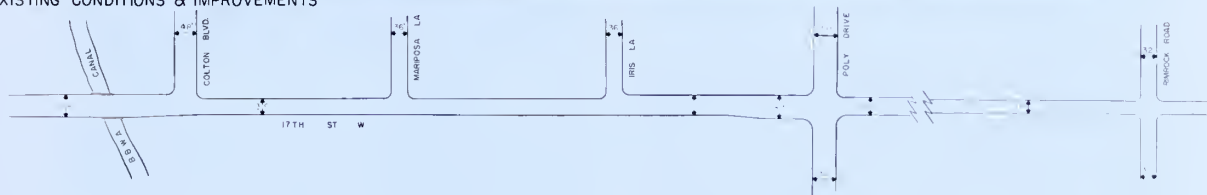
48' 35' BIT CONCRETE GOOD 48' 35' 27'

ABRFLK				1
HEAD-ON				
REAR-END	1		2	3
SIDE-SWIPK				
TURNING	1		2	
PARKING				
FIXED OBJECT			2	
PEDESTRIAN				
BACKING				
MISC.				
TOTAL	2		6	4

PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

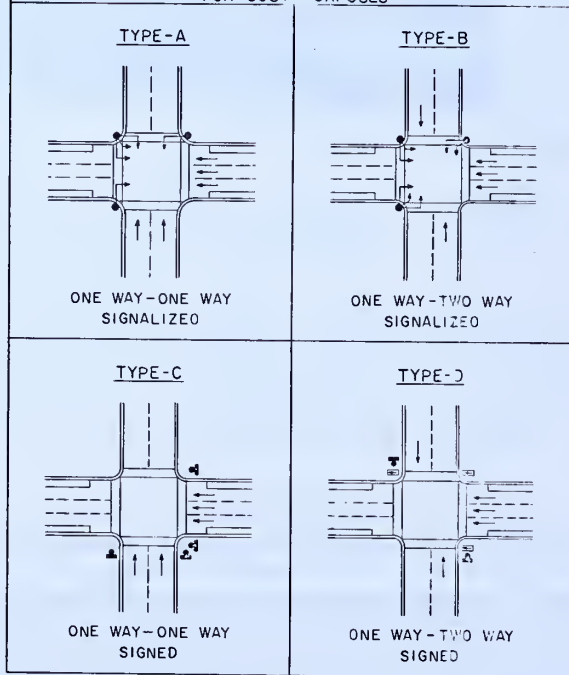


COSTS

AREA II COST SUMMARY

Location	Intersection Type	Cost
Rimrock Road-North 27th St. Intersection New Signals and channelization	-	\$20,000
Poly Drive-Grandview-Virginia Lane Intersection New Signals and channelization	-	\$45,000
Poly Drive-North 30th Street Intersection Minor Channelization (Costs on North 30th Street)	-	-
Poly Drive-Virginia Lane to 17th Street West Implement four lane	-	\$ 4,000
5th Street West-Parkhill Drive to Beverly Hill Boulevard Widen roadway (225')	-	\$30,000
17th Street West-Avenue G Add signing for emergency signal	-	\$ 300
SUBTOTAL		\$99,300
PLUS 15% for Engineering & Contingencies		14,895
ESTIMATED TOTAL COST -- AREA II		\$114,195

TYPICAL INTERSECTION SITUATIONS FOR COST PURPOSES



Type E = Two way - Two way signalized

AREA III - WEST CENTRAL CORRIDOR

The area is served in an east-west direction by the principal arterial, Grand Avenue and the minor arterial, Broadwater Avenue. Grand Avenue is on the Federal Aid Urban System and Broadwater Avenue has been designated as part of the Primary Type II System.

Traffic volumes on Grand Avenue range from 20,000 ADT on the east end and stay in this range out to 15th Street West where the volumes start to drop to around 4,000 ADT west of 24th Street West. The street serves the largest shopping area outside the CBD and it also functions as the main arterial between extensive residential sections and the CBD.

Broadwater Avenue parallels Grand Avenue seven blocks to the south and carries traffic volumes in the 12,000-7,000 range out to 19th Street West, dropping to 5,000 ADT west of 24th Street West. Broadwater traffic is primarily commuter traffic between the large residential area and the CBD. Few businesses are located along Broadwater Avenue, however, recent commercial developments near the extreme west limits may increase the traffic volumes in this area.

Grand Avenue-Division Street to 24th Street West

Problems - The high traffic volumes on this street cause some congestion during peak hours, but average highway speeds remain relatively high. Street widths vary from 48 feet to 70 feet which allows operation as a four-lane facility with parking removed on both sides for the major portion of the route. Several pedestrian crossings are located throughout its length and a 15 or 25 mph speed limit is imposed at some of these locations close to schools. The street is normally posted for a 35 mph speed limit.

It appears that the street operates well in consideration of its physical limitations, however, due to midblock interruptions and the absence of a progressive signal system, the street has a high accident record

Capacity - The signalized intersections along Grand Avenue are operating at an approximate level of service D during peak hours. Periods of standing delay are limited as can be seen on pages 126 thru 139 of the street inventory.

Accidents - The street is recording more than 200 accidents per year along its length from Division Street to 24th Street West. The highest concentration of accidents is at the intersections, but many midblock collisions are occurring in the vicinity of 12th Street West to 15th Street West due to the numerous business driveways.

The number of right angle collisions at the intersections indicate poor observance of the traffic control devices or defects in the traffic control system. Rear end collisions are a common occurrence at signalized intersections, and it appears that a large number of such accidents along Grand Avenue are the result of a high operating speed coupled with an uncoordinated signal system.

Recommended Improvements - It appears desirable to provide an interconnected signal system throughout the length of Grand Avenue. Effective platooning of the vehicular flow should eliminate some of the accidents and promote driver confidence by assuring right of way during peak hours. It is also possible that some of the midblock accidents can be reduced by providing adequate gaps for entering or crossing traffic.

Grand, Division and North 32nd Street - This intersection has been previously covered in Area I, 4th-6th Avenue North couplet. See Figure 24.

Grand and 3rd Street West - Recommended improvements are minor, however, permanent plastic pavement markings delineating the street width transition and the pedestrian crossing may improve the operation of the intersection.

Grand and 5th Street West - Approximately one-half of the accidents occurring at this intersection are either right angle or turning movement collisions. Since the signal installation is new, it appears that the offset between the north and south

approach on 5th Street West is a prime contributor. It is, therefore, recommended that the north approach on 5th Street West be aligned with the south approach to reduce this hazard. See Page 137.

Grand and 8th Street West - The unusual geometrics of this intersection and its isolated signal location are suspected of contributing to the high accident record. Sixty percent of the accidents are of the rear end type which would indicate poor signal timing, high approach speeds and inadequate signal indication. The nearest signal to the west is at 13th Street West and the nearest signal to the east is at 5th Street West. Although it is only three blocks to the east this signal is hidden by the crest of a hill between 5th Street West and 8th Street West.

Improvements should include modernization of the signal installation and more permanent type marking for the channelization of the width transition and turning lanes. Additional signing may also be desirable to alert drivers of the "signal ahead" situation.

12th Street West thru 17th Street West - This five block section is of particular concern to local officials due to its high accident rate and high traffic volumes complicated by the variety of businesses requiring numerous approach driveways. Some specific intersection improvements are recommended below, however, the entire section should be improved to an ultimate street section providing necessary turn bays.

Grand and 13th Street West - The accident records of this intersection indicate that the large off-set between the north and south approaches is responsible for a part of the accidents. It is recommended that the jog be eliminated as shown on page 133.

Grand and 14th Street West - Because this intersection is located near an elementary school, a school crosswalk complete with a 25 mph speed zone, advance warning signs and a flashing light has been located on each side of the street. The accident record, however, indicates that the intersection is experiencing both vehicular and pedestrian collisions to the extent that more

restrictive measures are necessary. Since it appears that both vehicular and accident warrants are satisfied, it is recommended that a traffic and/or pedestrian actuated signal be installed at this location.

Grand and 15th Street West - The span wire mounted signal head has recently been replaced with a modern signal installation. This should reduce some of the right angle and turning movement collisions that accounted for almost half of the accidents occurring at this intersection. Recommendations include only the interconnection of this signal with the others located along the avenue.

Grand and 17th Street West - Eleven right angle and turning movement collisions during 1970 are evidence that the present signal indication is inadequate. New signals are recommended at this location.

Evaluation - With the installation of a complete, modern signal system along Grand Avenue, it is anticipated that the greatest benefit will be the reduction in accidents. The minor channelization and widening should also help to route traffic and lessen driver confusion.

Capacity and overall travel times should also be improved. Platooning of vehicles will result in a more continuous movement with gaps large enough for traffic to enter from the numerous side streets and business approaches. Pedestrian traffic should also benefit from these improvements.

Broadwater Avenue - Division Street to 28th Street West

Problem - The avenue has a background similar to Grand Avenue. It originally functioned as a residential street serving a limited area and it is now operating as an arterial serving the large residential expansion that has occurred to the west. This development has resulted in a situation where the oldest, narrowest street sections are now serving the highest traffic volumes. Street widths vary from 39 feet to 40 feet from Division Street to 9th Street West and from 55 feet to 83 feet from 9th Street West

to the west limits except between 12th and 13th Streets West where the street narrows to approximately 27 feet. Another narrow section exists between 19th Street West and 22nd Street West where the street is approximately 35 feet wide.

Capacity - Capacity is limited on the section between Division Street and 5th Street West to approximately 1,000 vehicles per hour and is operating at an overall level of service between C and D. West of 5th Street West the street operates at the level of service B or C with only minor delays at the signalized intersections.

Accidents - Most accidents are occurring at the signalized intersections with the exception of the 15th Street West intersection. Accidents, however, do not appear to be a serious problem along the length of the street.

Recommended Improvements - Division to 9th Avenue West

To improve the level of service between Division and 5th Street West, it is proposed that Broadwater Avenue and Custer Avenue become a one-way couplet. This action should improve the operation of the Broadwater, Division, North 36th Street and 1st Avenue North intersection. Necessary modifications to the signal system and phasing are shown on Figure 25. The couplet could terminate at either 8th Street West or 9th Street West. Eighth Street West is presently signalized and easily adapted to the one-way couplet, however, to carry traffic beyond the narrow street section, the couplet should terminate at 9th Street West. Parking could be restored to Broadwater on one or both sides. After a reasonable length of operation, the intersections of 5th and 8th Streets West should be evaluated for possible removal of the signals, however, no parking could be allowed on Custer.

Lighting along the couplet should be improved. Existing lighting is inadequate for an arterial street and due to the residential nature of both Broadwater and Custer, the possible involvement of pedestrians in accidents would be reduced.

Broadwater and 8th Street West - The signal installation is

presently substandard and the accident records indicate an average of ten accidents per year that are susceptible to correction with a modern signal installation. This particular intersection should be checked for signal warrants after the implementation of a one-way couplet and if the warrants are met, a modern signal installation should replace the existing single span wire mounted signal head.

12th Street West to 14th Street West - The narrow 27 foot section of street that exists between 12th and 13th Streets West should be widened to at least the 52 foot width that exists west of 13th Street West. This narrow section is particularly bad from the east approach due to the four lane, 60 foot section that suddenly transitions to a two lane section near the crest of a hill and then narrows to 27 feet immediately beyond the 12th Street West intersection.

Broadwater and 16th Street West - This intersection has been recently improved by the addition of left turn storage lanes. The signal installation should be brought up to standard, however, with double indication and pedestrian heads.

19th Street West to Houle Drive - This 35 foot section of Broadwater is flanked by a 58 foot roadway to the east and a 50 foot section to the west. The total length of approximately 900 feet should be widened to accept four lanes of traffic and provide continuity and safety necessary for an arterial.

Parkview Drive to 28th Street West - The transition from an 83 foot wide street to a 40 foot street has been accomplished in about 150 feet. Good geometric design would require three times this distance. A future project should include improvements to this transition.

Evaluation - The one-way couplet proposed between Division and 8th or 9th Streets West will, at least, double the capacity of the section depending on how the parking is handled. The balance of the improvements should provide a reasonably smooth operating arterial with a possible reduction in accidents and increased driver comfort.

Lewis Avenue-Intersection with 8th Street West

Problem - The avenue functions as an east-west collector providing access from the immediate residential area to the CBD. It can provide additional relief to the high volumes on Grand Avenue during peak hours if minor improvements are made. The intersection with 8th Street West presents a hazardous condition due to the large offset that must be traversed in an east-west direction.

Capacity - Between Division Street and 8th Street West the avenue is 34 feet wide and accomodates two lanes of traffic with parking on the south side only. Average daily traffic is near 5,000 vehicles indicating a volume/capacity ratio of approximately 0.75.

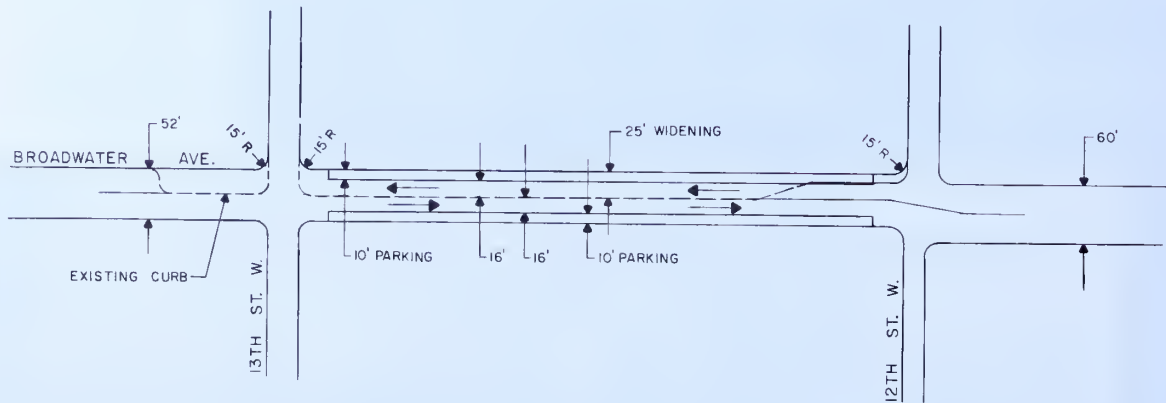
Accidents - The intersection has been averaging 3 to 4 reportable accidents per year for the past six years. Fifty percent of the accidents are of the rear end type with the balance of the accidents involving right angle or turning movements.

Recommended Improvements - With the purchase of a minimum amount of right of way east of 8th Street West, it is possible to provide a smooth transition through the intersection. Volumes do not require signalization, however, any traffic control assigned to the intersection should provide greater safety and smoother operation. Estimated Cost, \$95,000. See figure 31.

Evaluation - As noted above, it is possible to handle some of the peak hour load from Grand Avenue on Lewis. The improvement will make better provision for the possible increase in traffic and do it more safely and smoother.



FIGURE 29



AREA III

PROBLEM LOCATION
Broadwater Widening
Between 12th & 13th Sts. W.

FIGURE 30

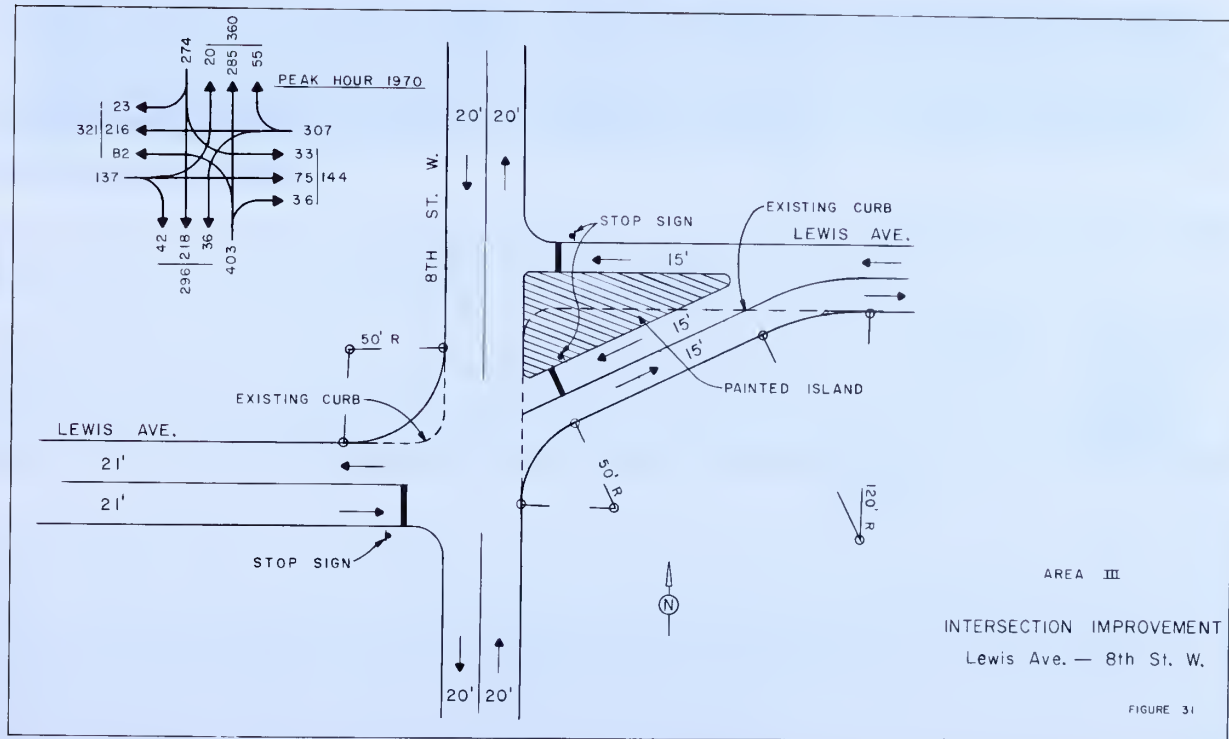


FIGURE 31

BILLINGS TOPICS

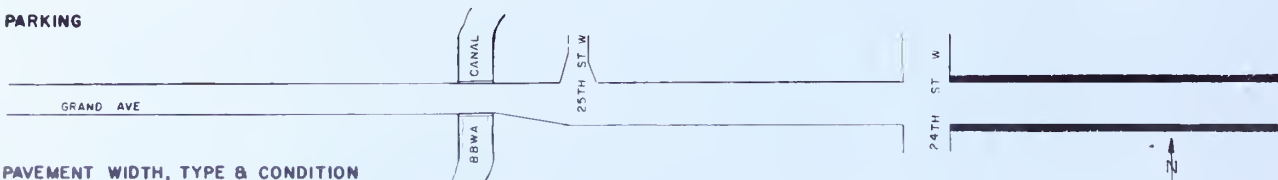
LEGEND

CLASSIFICATION

Principal Arterial

NO PARKING

PARKING



PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1969 THRU 1971

ANGLE	1	
HEAD-ON		
REAR-END	1	
SIDE-SWIP		
TURNING	2	
PARKING		
FIXED OBJECT		
PEDESTRIAN		
BACKING		
MISC.		
TOTAL	4	

4-1-70 TO 8-13-70

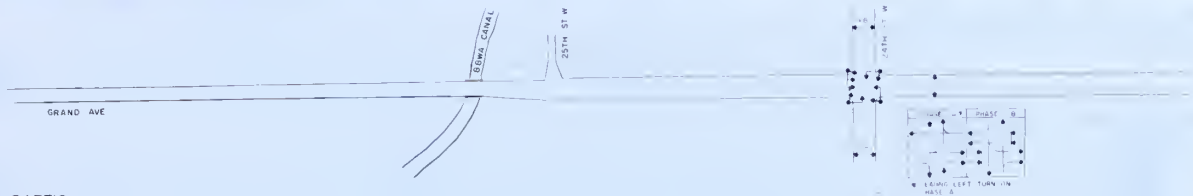
SPEED & DELAY



PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE

COSTS

NO PARKING

PARKING

GRAND AVE

22ND ST W

21ST ST W

ST W

19TH ST W

PAVEMENT WIDTH, TYPE & CONDITION

48'
BIT. CONCRETE
GOOD

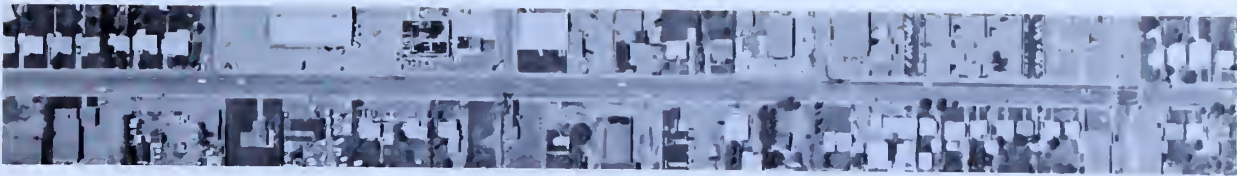
ACCIDENT SUMMARY 1969 THRU 1971

AWELK		2			
HEAD-ON				1	
REAR-END	2			2	
SIDE SWIPE	1	3			
TURNING	1	2		1	2
PARKING					
FIXED OBJECT				1	
PEDESTRIAN					1
BACKING	1	1			
MISC.					
TOTAL	5	8		6	3

1-1-70 TO 8-13-70

SPEED & DELAY

PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

A	
B	
C	
D	
E	

COSTS

BILLINGS TOPICS

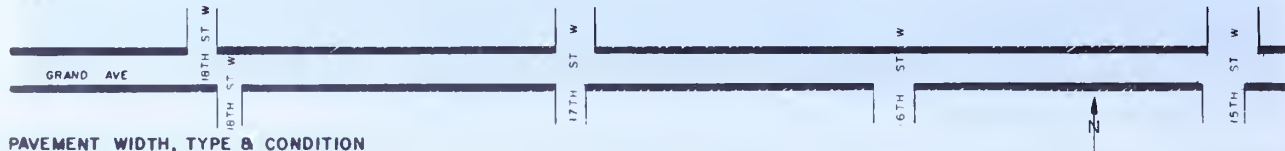
LEGEND

NO PARKING

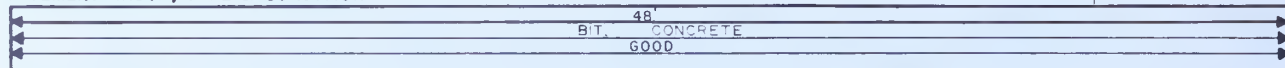
CLASSIFICATION

Principal Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

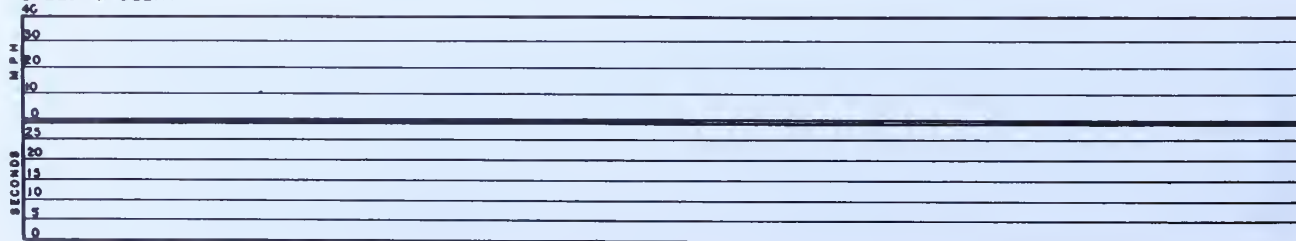


ACCIDENT SUMMARY 1969 THRU 1971

ANGLE		4	3	8
HEAD-ON				
REAR-END	2	6	9	7
SIDE SWIPE			1	1
TURNING	2	8	1	5
FIXED OBJECT				
PEDESTRIAN				
BACKING				
MISC.	1			
TOTAL	5	24	14	21

1-1-70 TO 8-13-70

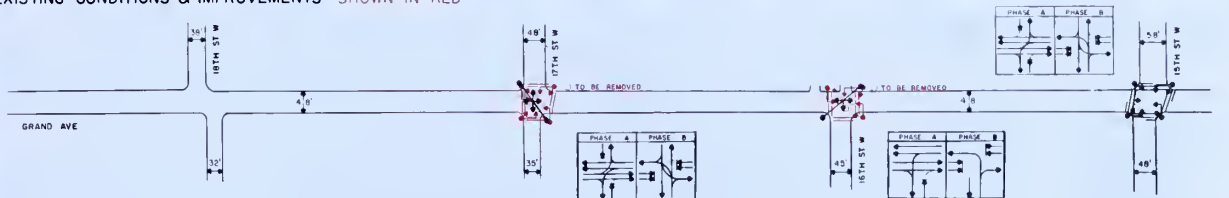
SPEED & DELAY



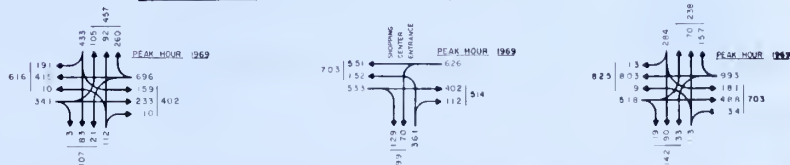
PLAN VIEW



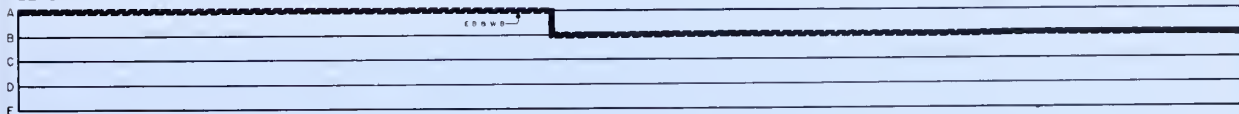
EXISTING CONDITIONS & IMPROVEMENTS SHOWN IN RED



TRAFFIC



LEVEL OF SERVICE



COSTS

TYPE E	TYPE E
\$12,000	\$11,500
TOTAL COST THIS SECTION - \$23,500	

BILLINGS TOPICS

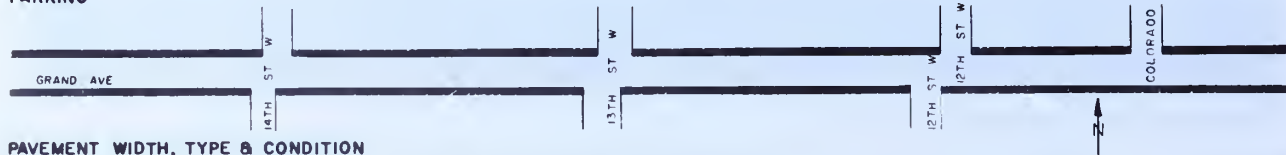
LEGEND

CLASSIFICATION

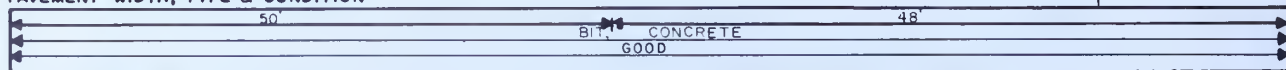
Principal Arterial

NO PARKING

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

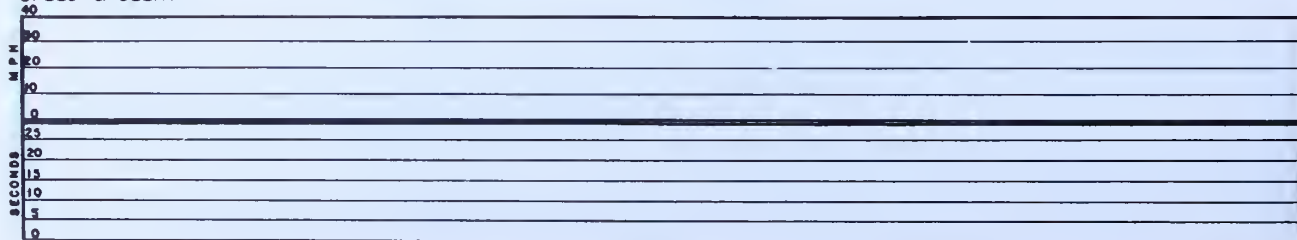


ACCIDENT SUMMARY 1969 THRU 1971

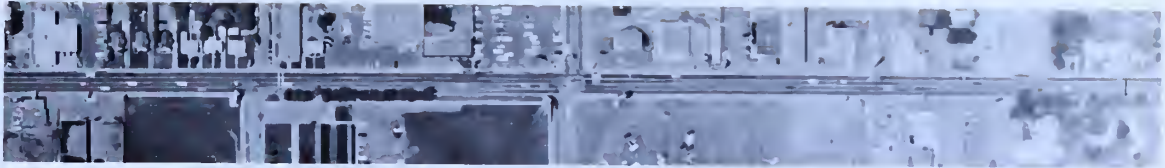
HEAD-ON	4	2	3
REAR-END	6	15	4
SIDE SWIPE	2	3	2
TURNING	5	6	4
PARKING			
FIXED OBJECT			2
PEDESTRIAN	1		
BACKING			
MISC.			
TOTAL	18	26	15

1-1-70 TO 8-13-70

SPEED & DELAY



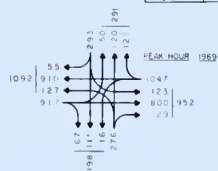
PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE

A	
B	
C	
D	
E	

COSTS

TYPE E	TYPE E
\$12,000	\$6,500
TOTAL COST THIS SECTION = \$18,500	

BILLINGS TOPICS

LEGEND

NO PARKING

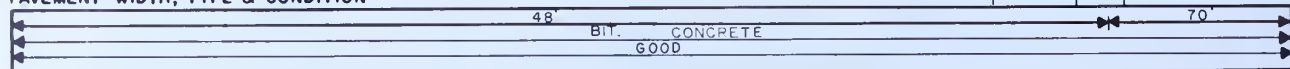
CLASSIFICATION

Principal Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

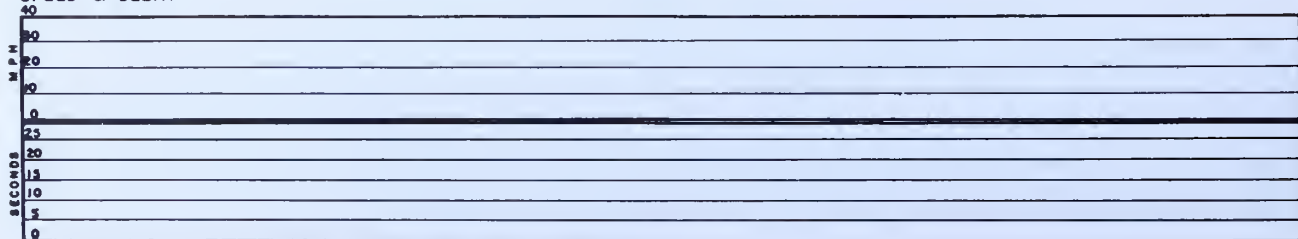


ACCIDENT SUMMARY 1969 THRU 1971

	ANGLE	4	1	5
6	HEAD-ON	13	1	6
	REAR-END	1	7	
	SIDEWIPED	2	4	1
3	TURNING	2	1	4
	PARKING	1		1
1	FIXED OBJECT		2	
	PEDESTRIAN		16	27
	BACKING			
	MISC.			
TOTAL 10		23		

1-1-70 TO 8-13-70

SPEED & DELAY



An aerial photograph of a residential street. The street runs horizontally across the middle of the frame. On both sides of the street, there are houses and trees. The houses are mostly single-story buildings with light-colored roofs. The trees are dark green and scattered throughout the landscape. The overall scene is a typical suburban neighborhood.

A

B

C

D

E

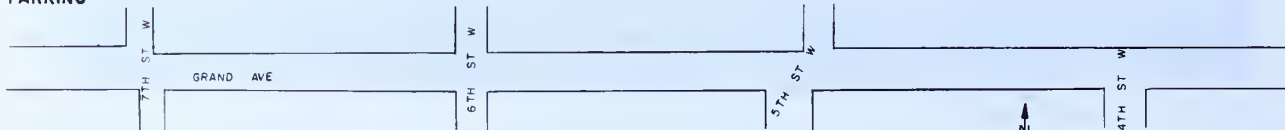
F

	PAVEMENT MARKING
	\$ 3,000
TOTAL COST THIS SECTION = \$ 3,000	

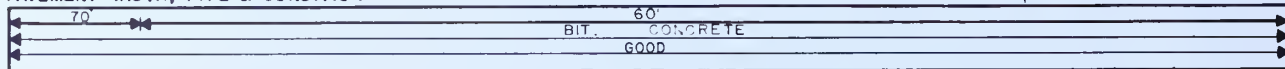
CLASSIFICATION

Principal Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1969 THRU 1971

ANGLE	1	2	4		
HEAD-ON					
REAR-END	2	3	9	3	
SIDE SWIPE					
TURNING		1	2	1	
PARKING	5			1	
FIXED OBJECT			1		
PEDESTRIAN					
BACKING					
MISC.					
TOTAL	8	7	17	5	

1-1-70 TO 8-13-70

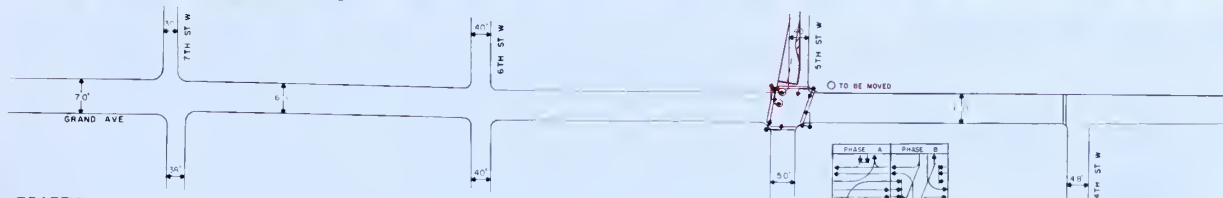
SPEED & DELAY

40	
30	
20	
10	
0	
23	
20	
15	
10	
5	
0	

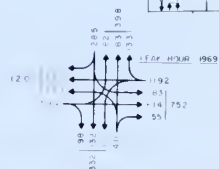
PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE

A	
B	
C	
D	
E	

COSTS

TYPE E
\$ 7,000
TOTAL COST THIS SECTION = \$ 7,000

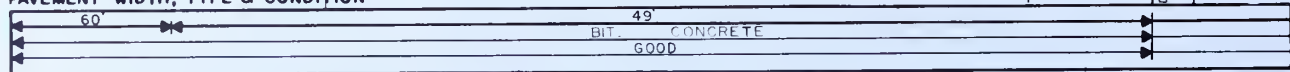
CLASSIFICATION

Principal Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

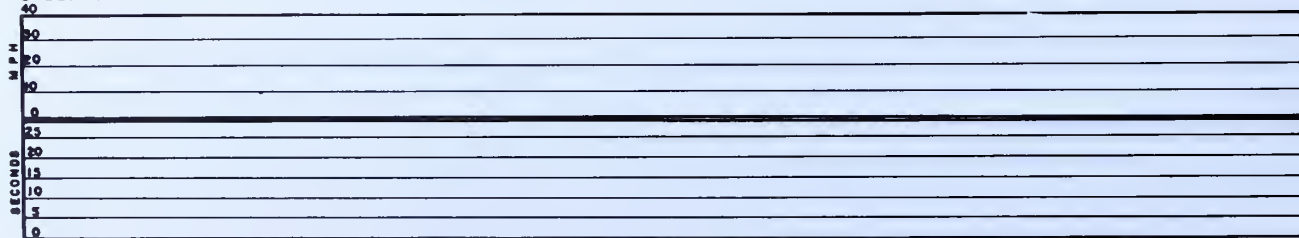


ACCIDENT SUMMARY 1969 THRU 1971

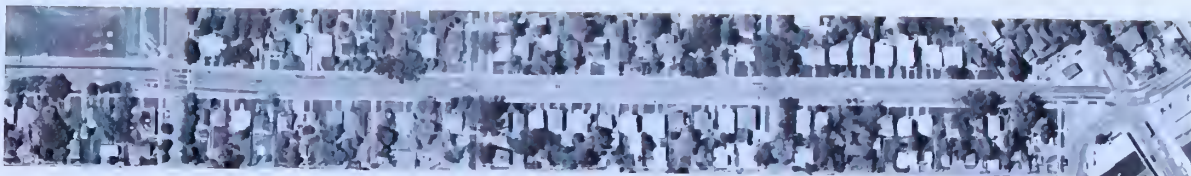
ANGLE	4	1	1
HEAD-ON			
REAR-END	4	2	2
SIDESWIP		1	1
TURNING			3
PARKING			
FIXED OBJECT			1
PEDESTRIAN			
BACKING			
MISC.			
TOTAL	8	4	8

11-70 TO 8-13-70

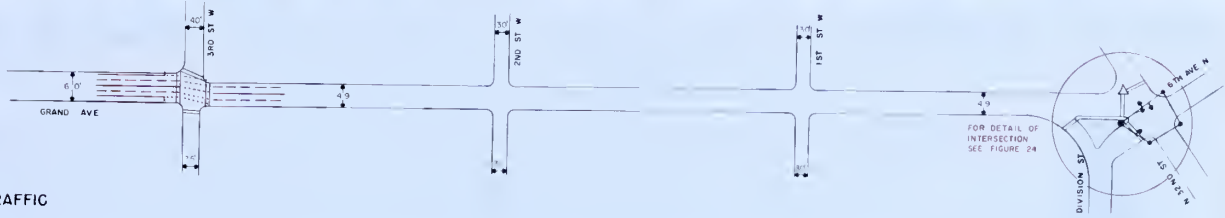
SPEED & DELAY



PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

A	
B	
C	
D	
E	

COSTS

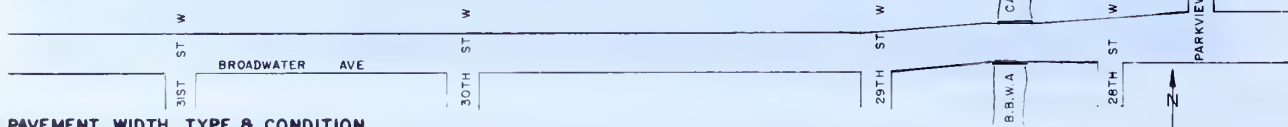
PAVEMENT MARKING	\$ 3,000
TOTAL COST THIS SECTION = \$ 3,000	

BILLINGS TOPICS

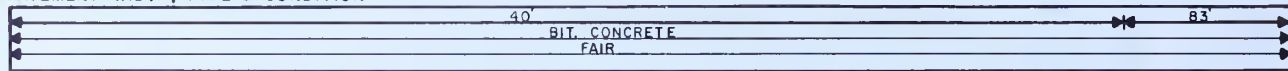
CLASSIFICATION

Minor Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION



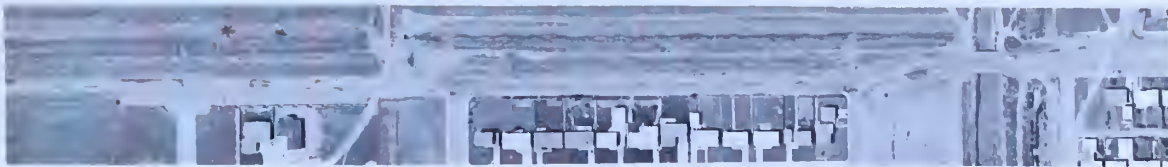
ACCIDENT SUMMARY 1969 THRU 1971

ANGLE	
HEAD-ON	
REAR-END	
SIDE-SWIP	
TURNING	
PARKING	
FIXED OBJECT	
PEDESTRIAN	
BACKING	
MISC.	
TOTAL	

SPEED & DELAY



PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

A	
B	
C	
D	
E	

COSTS

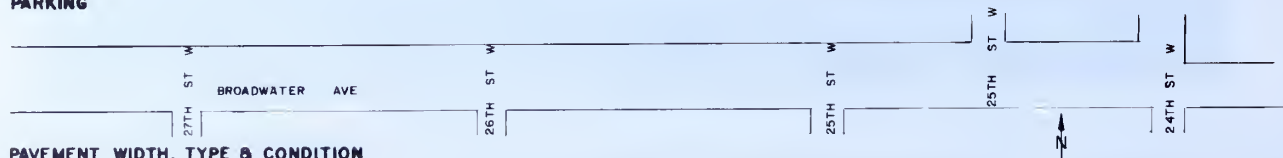
	WIDENING & PAVEMENT MARKING
	\$ 7,500
	TOTAL COST THIS SECTION = \$ 7,500

BILLINGS TOPICS

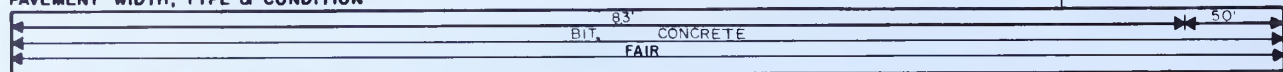
CLASSIFICATION

Minor Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION



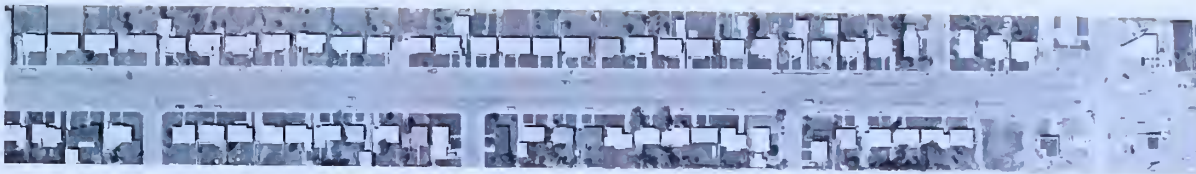
ACCIDENT SUMMARY 1969 THRU 1971

AT-BL	2
HEAD-ON	6
REAR-EN	1
SIDE SWIP	6
TURNING	2
PARKING	
FIXED OBJECT	
PEDESTRIAN	
LACKING	
WTC	
TOTAL	21

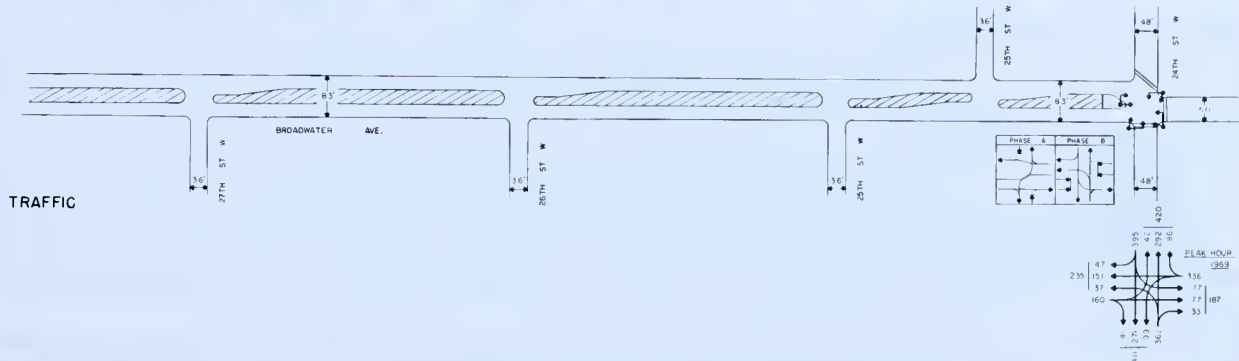
(69-71)

SPEED & DELAY





EXISTING CONDITIONS & IMPROVEMENTS

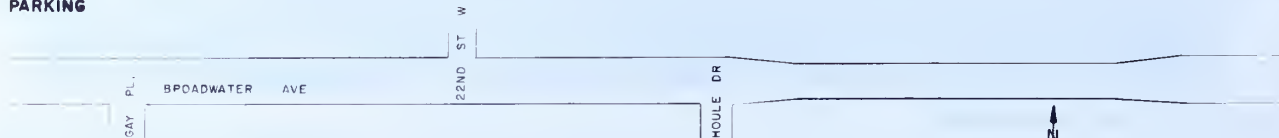


BILLINGS TOPICS

CLASSIFICATION

Minor Arterial

PARKING



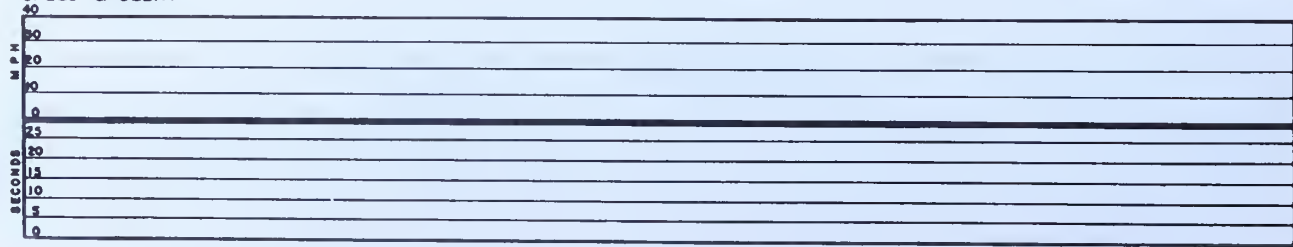
PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1969 THRU 1971

ANGLE
HEAD-ON
REAR-END
SIDESWIP
TURNING
PARKING
FIXED OBJECT
PEDESTRIAN
BACKING
MISC.
TOTAL

SPEED & DELAY



PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

A	
B	
C	
D	
E	

COSTS

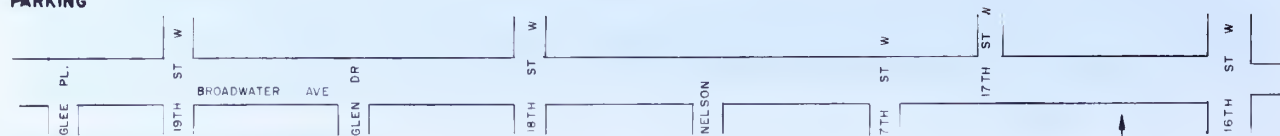
	NEW CURB & GUTTER — NEW PAVEMENT	
	\$45,000	
	TOTAL COST THIS SECTION = \$45,000	

BILLINGS TOPICS

CLASSIFICATION

Minor Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

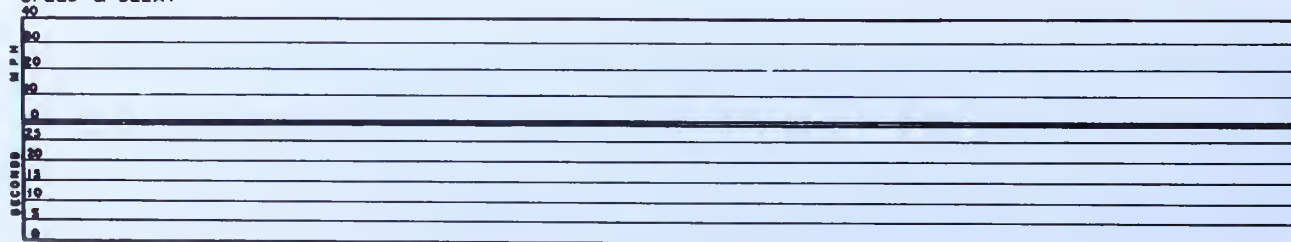


ACCIDENT SUMMARY 1969 THRU 1971

ANGLE	2			10
HEAD-ON				1
REAR-END	5	1		11
SIDE SWIPE				
TURNING	6			7
PARKING	2			
FIXED OBJECT				
PEDESTRIAN	1			1
BACKING	1			
MISC.				
TOTAL	27	1		30

$\{-1-69 \quad \text{TO} \quad |2-3| -71\}$

SPEED & DELAY



EXISTING CONDITIONS & IMPROVEMENTS

TRAFFIC

19TH ST W

GLEE PL.

BROADWATER AVE

GLEN DR

18TH ST W

NELSON

17TH ST W

17TH ST W

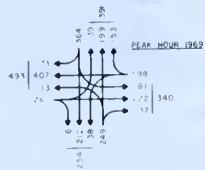
16TH ST W

TO BE REMOVED

PHASE A

PHASE B

TRAFFIC



Year	ED (Solid Line)	WB (Dashed Line)
1978	A	A
1979	B	B
1980	B	B
1981	B	B
1982	B	B
1983	B	B
1984	B	B
1985	B	B
1986	B	B
1987	B	B
1988	B	C

COSTS		TYPE E
		\$12,000
TOTAL COST THIS SECTION • \$12,000		

TYPE E
\$12,000

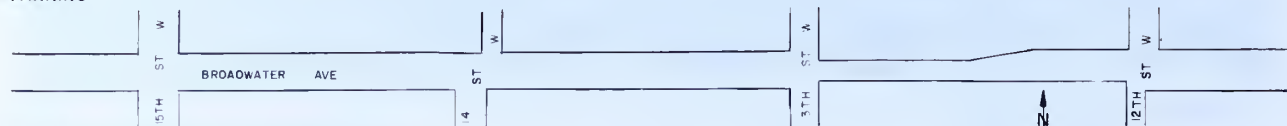
TOTAL COST THIS SECTION = \$12,000

BILLINGS TOPICS

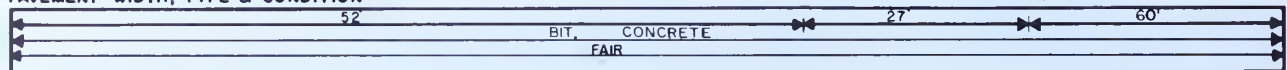
CLASSIFICATION

Minor Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1969 THRU 1971

ANGLE	12	0
HEAD-ON	15	5
REAR-END	1	2
SIDE SWIPE	9	2
TURNING	1	1 (HORSE)
PARKING		18
FIXED OBJECT		
PEDESTRIAN		
RACKING		
MISC.		
TOTAL	38	
	(69-71)	(69-71)

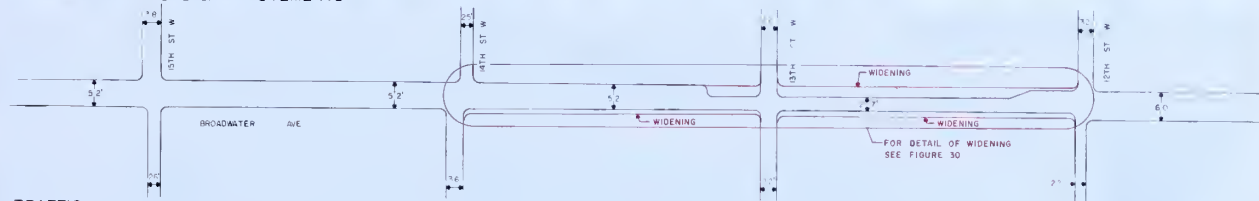
SPEED & DELAY

30	
20	
10	
0	
SECONDS	
25	
20	
15	
10	
5	
0	

PLAN VIEW

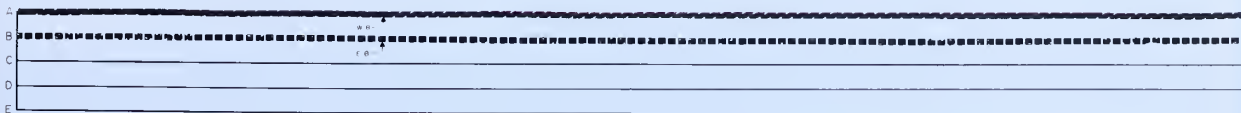


EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE



COSTS



BILLINGS TOPICS

LEGEND

NO PARKING

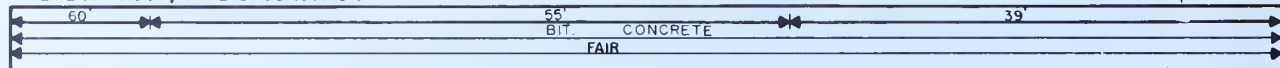
CLASSIFICATION

Minor Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

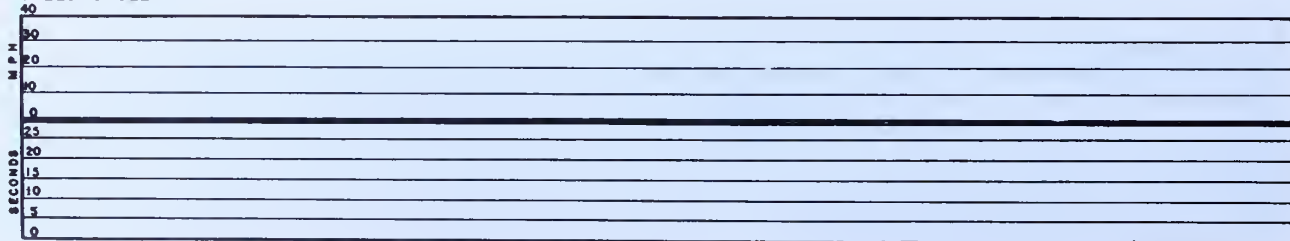


ACCIDENT SUMMARY 1969 THRU 1971

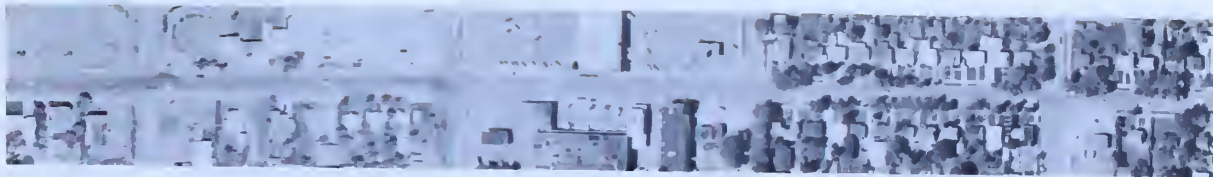
ANGLE	14
HEAD-ON	13
REAR-END	4
SIDE SWIPE	17
TURNING	1
PARKING	
FIXED OBJECT	
PEDESTRIAN	
BACKING	
MISC.	
TOTAL	49

(69-71)

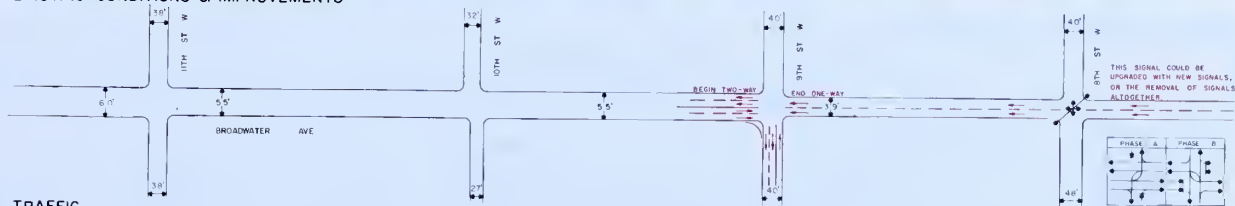
SPEED & DELAY



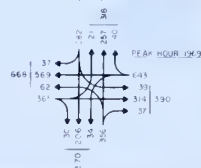
PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE

A	
B	
C	
D	
E	

COSTS

BILLINGS TOPICS

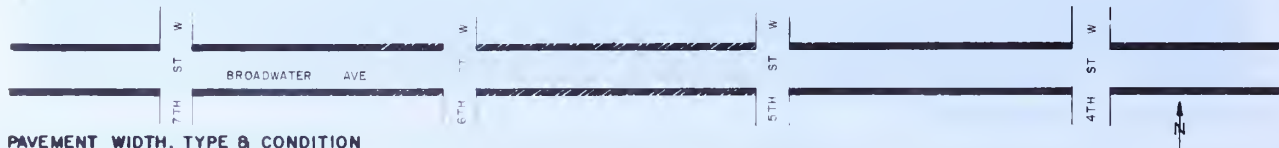
LEGEND

CLASSIFICATION

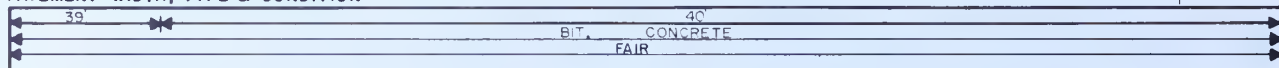
Minor Arterial

NO PARKING

PARKING



PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1969 THRU 1971

ANGL	9	
HEAD-ON	10	3
REAR-END	4	1
SIDE-SWIP	3	3
TURNING	3	3
PARKING	2	1
FIXED OBJECT		
PEDESTRIAN		
BACKING		
MISC.		
TOTAL	47	13
	(69-71)	(69-71)

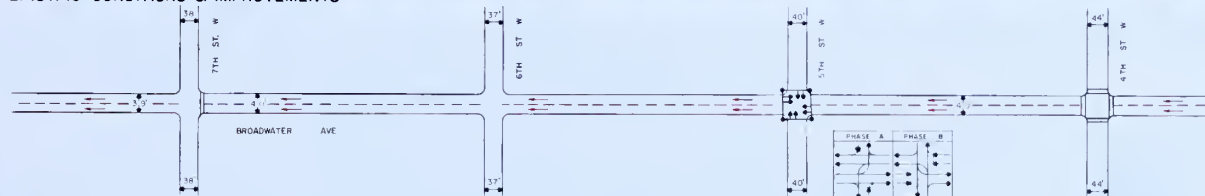
SPEED & DELAY



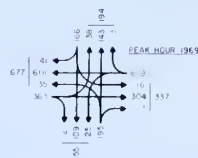
PLAN VIEW



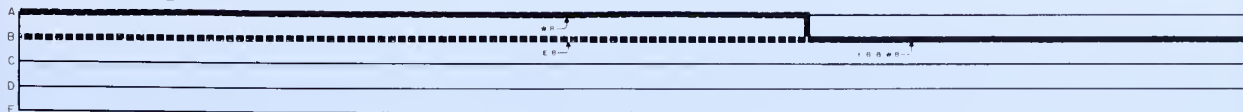
EXISTING CONDITIONS & IMPROVEMENTS



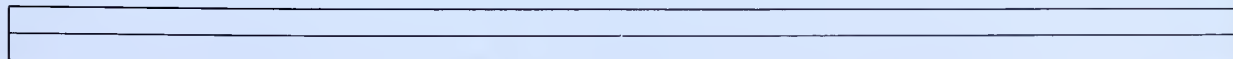
TRAFFIC



LEVEL OF SERVICE



COSTS



BILLINGS TOPICS

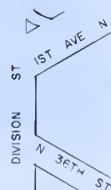
LEGEND

CLASSIFICATION

Minor Arterial

NO PARKING

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

40'
BIT. CONCRETE
FAIR

ACCIDENT SUMMARY 1969 THRU 1971

ANGLE
HEAD-ON
REAR-END
SIDE SWIPE
TURNING
PARKING
FIXED OBJECT
PEDESTRIAN
BACKING
MISC.
TOTAL

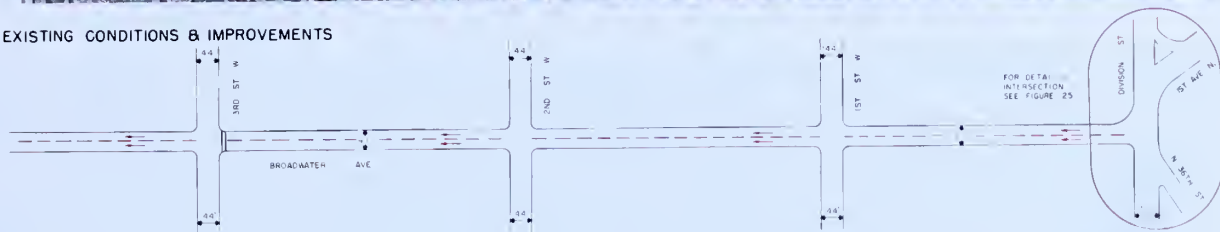
SPEED & DELAY

40
30
20
10
0
25
20
15
10
5
0

PLAN VIEW

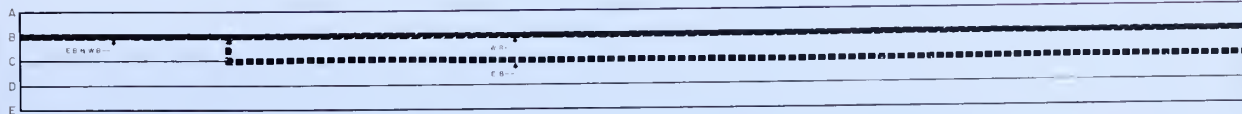


EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE



COSTS

TOTAL COST TO MAKE BROADWATER AVE ONE-WAY WEST BOUND FROM DIVISION ST TO 9TH ST W = \$ 7,500

BILLINGS TOPICS

LEGEND

NO PARKING
METERED PARKING
RESTRICTED PARKING



CLASSIFICATION

Local Street

Minor Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

36'
BIT. CONCRETE
GOOD

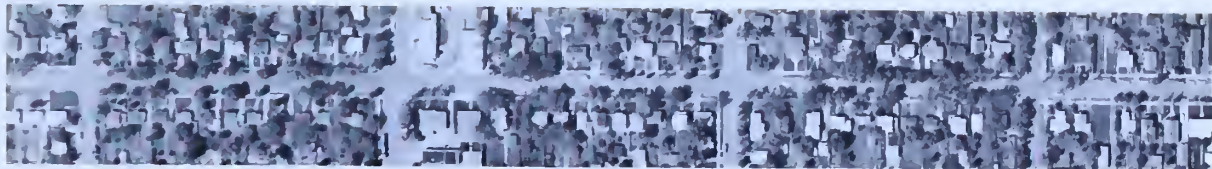
ACCIDENT SUMMARY 1965 THRU 1968

ANGLE
HEAD-ON
REAR-END
SIDE SWIPE
TURNING
PARKING
FIXED OBJECT
PEDESTRIAN
BACKING
MISC.
TOTAL

SPEED & DELAY

40
30
20
10
0
25
20
15
10
5
0

PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

COSTS

BILLINGS TOPICS

LEGEND

NO PARKING
METERED PARKING
RESTRICTED PARKING



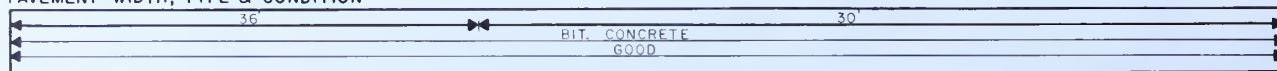
CLASSIFICATION

Minor Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1965 THRU 1968

ANGLE
HEAD-ON
REAR-END
SIDE-SWIPe
TURNING
PARKING
FIXED OBJECT
PEDESTRIAN
BACKING
MISC.
TOTAL

SPEED & DELAY

40
30
20
10
0
25
20
15
10
5
0

PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

COSTS

BILLINGS TOPICS

LEGEND

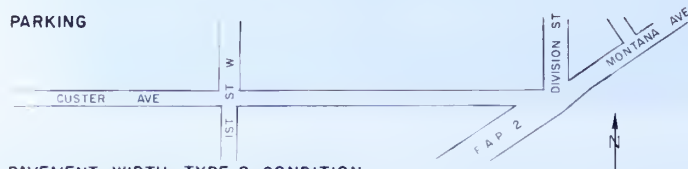
NO PARKING
METERED PARKING
RESTRICTED PARKING



CLASSIFICATION



PARKING



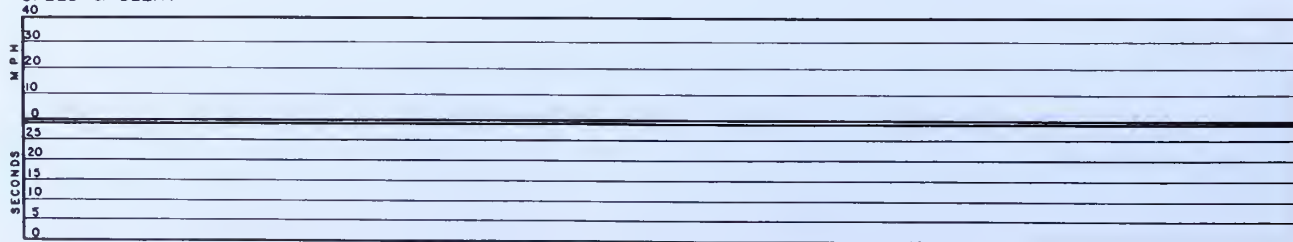
PAVEMENT WIDTH, TYPE & CONDITION

30'
BIT. CONCRETE
GOOD

ACCIDENT SUMMARY 1965 THRU 1968

ANGLE
HEAD-ON
REAR-END
SIDE-SWIP
TURNING
PARKING
FIXED OBJECT
PEDESTRIAN
BACKING
MISC.
TOTAL

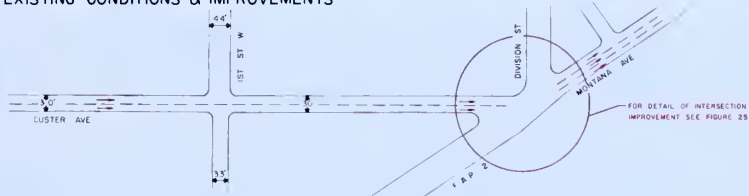
SPEED & DELAY



PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

COSTS

BILLINGS TOPICS

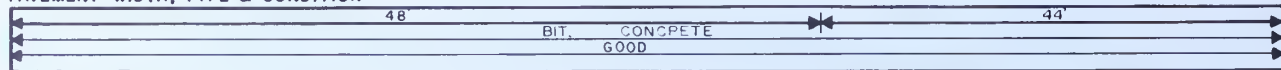
CLASSIFICATION

Principal Arterial

PARKING



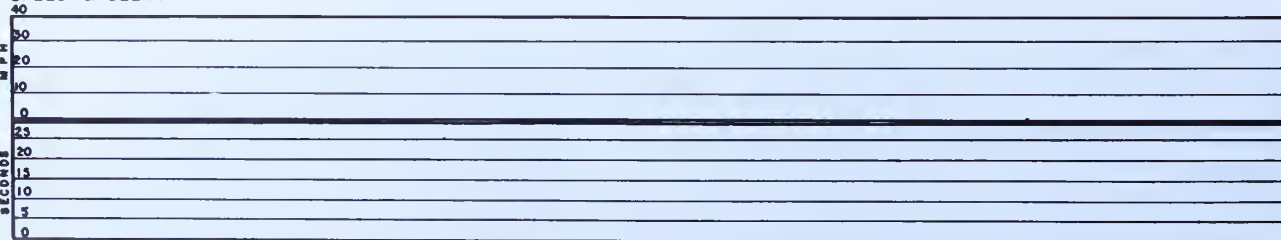
PAVEMENT WIDTH, TYPE & CONDITION



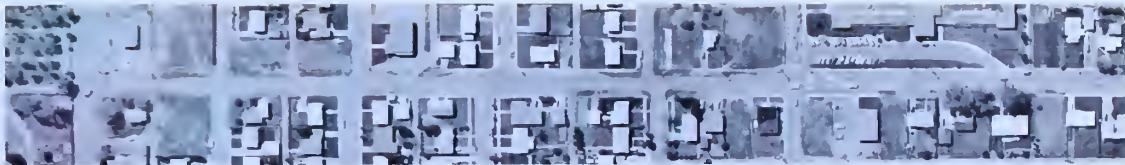
ACCIDENT SUMMARY 1969 THRU 1971

3	ANGLE					2
3	HEAD-ON					
1	REAR-END	1		1		
1	SIDE SWIPE					
4	TURNING	1			1	
1	PARKING					
	FIXED OBJECT					
	PEDESTRIAN					
	BACKING					
	MISC.					
TOTAL 12		2		1	1	2

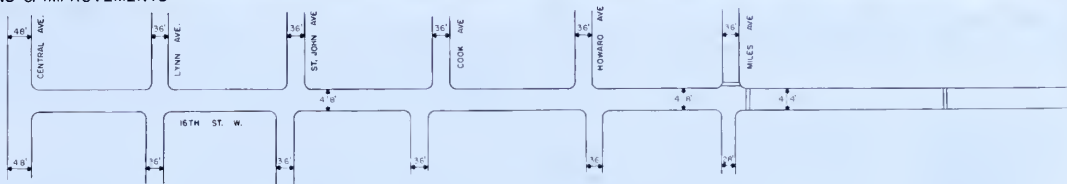
SPEED & DELAY



PLAN VIEW

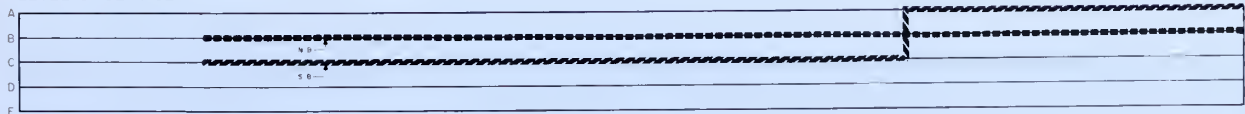


EXISTING CONDITIONS & IMPROVEMENTS



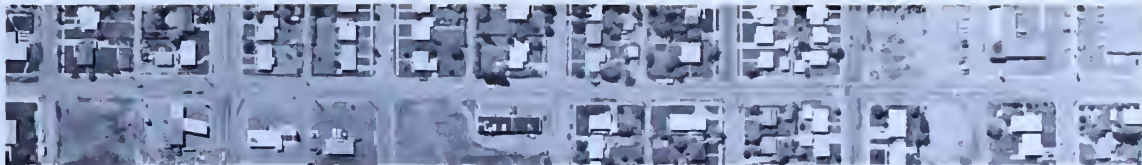
TRAFFIC

LEVEL OF SERVICE



COSTS

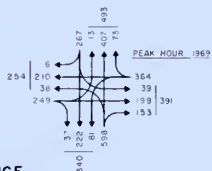
PLAN VIEW



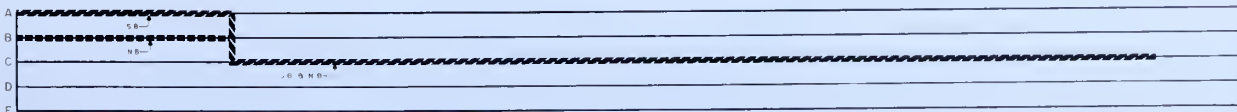
EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE



COSTS

BILLINGS TOPICS

LEGEND

NO PARKING

CLASSIFICATION



PARKING



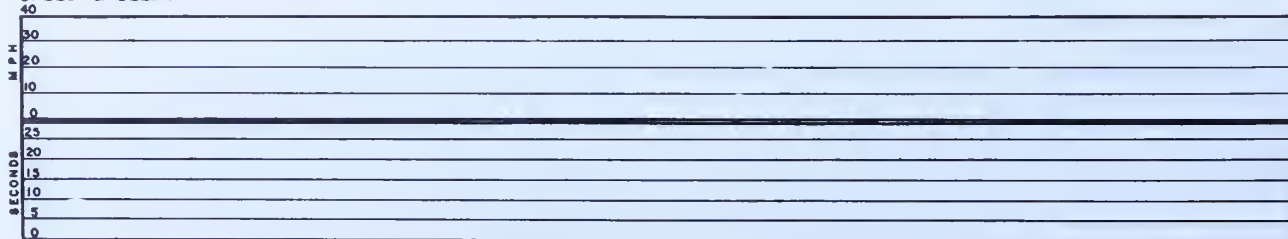
PAVEMENT WIDTH, TYPE & CONDITION

45	
BIT. CONCRETE	
GOOD	

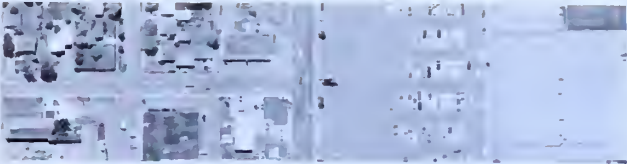
ACCIDENT SUMMARY 1969 THRU 1971

ANGLE		1
HEAD-ON		
REAR-END		7
SIDE-SWIP		1
TURNING	1	1
PARKING		
FIXED OBJECT	1	
PEDESTRIAN		
BACKING		
MISC.		
TOTAL	3	10

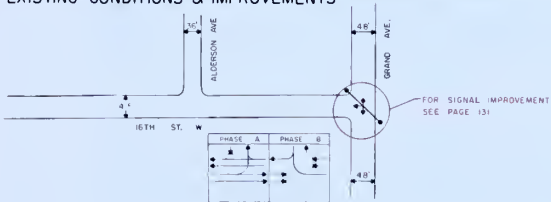
SPEED & DELAY



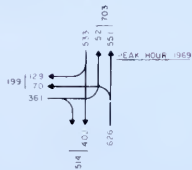
PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE

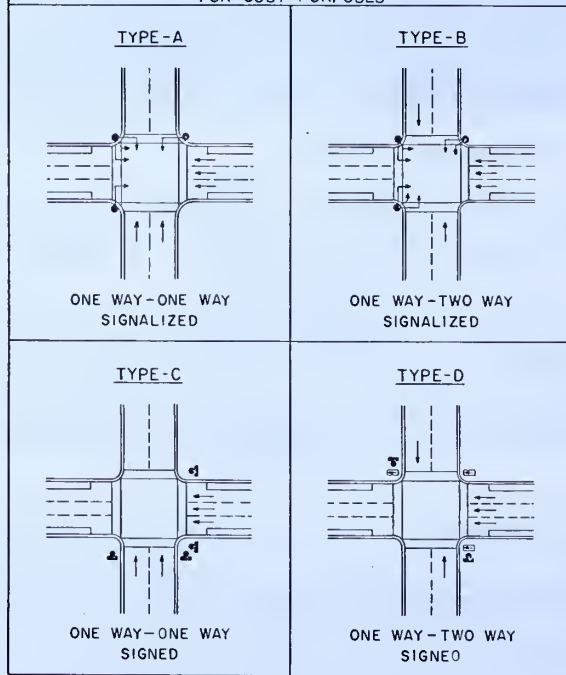
A	
B	
C	
D	
E	

COSTS

AREA III COST SUMMARY

Location	Intersection Type	Cost
Lewis-8th Street West Intersection Remove Jog on Lewis	Special	\$95,000
Grand-17th Street West Intersection	Type E	
Grand-16th Street West Intersection	Type E	
Grand-14th Street West Intersection Modernize Signals	Type E	35,500
Grand-13th Street West Intersection Revise South Approach	-	6,500
Grand-8th Street West Intersection Permanent Type Pavement Markings	-	3,000
Grand-5th Street West Intersection Revise North Approach	-	7,000
Grand-3rd Street West Intersection Permanent Type Pavement Markings	-	3,000
Broadwater-Parkview Drive Lengthen 2-4 Lane Transition	-	7,500
Broadwater-19th Street West Widen Roadway for approximately 900'	-	45,000
Broadwater-16th Street West Intersection Type E		12,000
Broadwater-12th to 14th Street West Widen Roadway	-	50,000
Broadwater-Custer Avenues Implement One-Way Couplet	-	7,500
SUBTOTAL		\$277,000
PLUS 15% Engineering & Contingencies		41,550
ESTIMATED TOTAL COST -- AREA III		\$318,550

TYPICAL INTERSECTION SITUATIONS FOR COST PURPOSES



Type E = Two Way - Two Way Signalized

AREA IV - SOUTHWEST CORRIDOR

This area is served primarily by the east-west arterial Central Avenue. Service is also provided by Moore Lane, a north-south collector that provides the most direct access to the Interstate System and the area south of the railroad tracks.

Central Avenue traffic varies from 12,000 ADT at the junction of 6th Street West to approximately 3,000 ADT at 24th Street West. Street widths vary from 40 feet to 66 feet with most of the street operating as four lanes with parking removed in the narrower sections. The area is basically residential, however, the commercial-industrial area lying south of the street accounts for a portion of the traffic volumes and a higher commercial vehicle count.

Central Avenue-Montana Avenue to 24th Street West

Problems - Generally, for the traffic volumes involved, the street operates reasonably well. The single biggest problem is access to the CBD located north of the railroad. Presently, the one block between 5th Street West and 6th Street West operates as a westbound, one way facility and consequently, does not provide a desirable route for the eastbound flow of traffic. The restricting of traffic to a one way flow in the one block section was necessary due to the complications of intersecting Montana Avenue at an extreme angle at the east end of the long railroad overpass. Eastbound traffic is now diverted at the 6th Street West intersection either to the south, under I-90 business route and the railroad, or to the north where most traffic continues north to Broadwater Avenue before resuming an eastbound direction. The traffic diverted to the south continues eastbound via Minnesota Avenue and eventually terminates in the CBD area after crossing the Burlington Northern Railroad on North 27th, 28th or 29th Streets.

Traffic that is diverted north to Broadwater Avenue adds to the volumes that must traverse the Broadwater Avenue-Division Street intersection. This intersection suffers from poor geometrics and averages more than ten accidents per year. Although

improvements have been recommended for this intersection, page 29, it would still be desirable to divert the ever-increasing volumes of Central Avenue traffic from this area. The Billings Urban Transportation Study indicates that traffic volumes will increase approximately 70% by 1990 on Central Avenue and approximately 40% on Broadwater Avenue.

Capacity - Capacity is controlled on the four lane facility by the signalized intersections. The intersection with 6th Avenue West appears to be the most critical and capacity has been calculated at 1100 vph indicating a volume/capacity ratio of approximately 0.50. This low ratio, however, has been attained at the expense of routing eastbound traffic out of their way and is not really an indicator of the volumes involved.

Accidents - Due to the traffic flow at the intersection of 6th Street West approximately 50 percent of the reported accidents involve turning movements. This intersection also has the highest number of reported accidents along Central Avenue which has been amounting to an average of seven accidents per year. The balance of Central Avenue is relatively free of other high accident areas.

Recommended Improvements - A single improvement is recommended at this time. To provide better access to Montana Avenue and the CBD, it is recommended that the plan as outlined on figure 33, page 166, be given a high priority. The suggested ramp could be constructed with a minimum of right-of-way taking and at a comparatively low cost when considering the location and benefits involved. The addition of the ramp will not only provide a better flow of traffic in the vicinity of 6th Avenue West, but should provide a more efficient flow of traffic in the vicinity of Division Street as the Montana-1st Avenue North one-way couplet is implemented.

The heavy left turn movements at the intersection of 6th Avenue West and the truck by-pass (Loop FAP 2) and the left turns at 1st Avenue South and 27th, 28th and 29th Streets will also benefit from this improvement.

Evaluation - Central Avenue is operating well within its capacity with only one intersection of major concern. The improvement re-

commended above should help to alleviate the volumes on Broadway and most particularly, at the intersection of Broadway and Division. Good access should also divert some of the traffic off Moore Lane where a bad accident problem exists and a potential for increased problems due to the industrial buildup of this area.

The intersection of 8th Street West and Central may also experience some benefits from the suggested improvement due to the decrease in turning movement volumes.

Moore Lane and U. S. 10

Problem - The intersection has been experiencing an increase in accidents coincident with the development of both the industrial and residential areas north of the Burlington Northern tracks. The narrow, at-grade crossing located just off U. S. 10 has created an unsafe condition for the larger trucks that must either encroach on adjacent traffic lanes during turning maneuvers or store in the through traffic lane on U. S. 10. No storage length is available for southbound movements that are occasionally caught on the railroad crossing due to a delay in traffic entering U. S. 10.

Capacity - Capacity apparently is not a problem at the present time. The installation of a traffic actuated signal may reduce

the free flow of westbound traffic, but capacity on four lane U. S. 10 should remain adequate.

Accidents - The intersection area, including the at-grade crossing, is averaging 15-20 accidents per year. Most involve westbound traffic on U. S. 10 and traffic turning from the approach towards the east. Accidents involving these movements should be reduced considerably with the installation of traffic signals.

Recommended Improvements - Since adequate warrants for signalization exist, it is proposed that improvements consist of an increased turning radius for the east to north movement, a wider at-grade crossing and a signal system that would include a railroad preemption preventing traffic southbound on Moore Lane from storing on the railroad crossing. The plan also provides for a storage lane parallel to the westbound lanes on U. S. 10. The storage is intended for those units that must wait during a railroad preemption phase and presently block the thru traffic lane.

Evaluation - The improvement is intended to provide a safer crossing and should reduce the number of vehicular accidents considerably. The hazard involving train movements should also be greatly reduced.

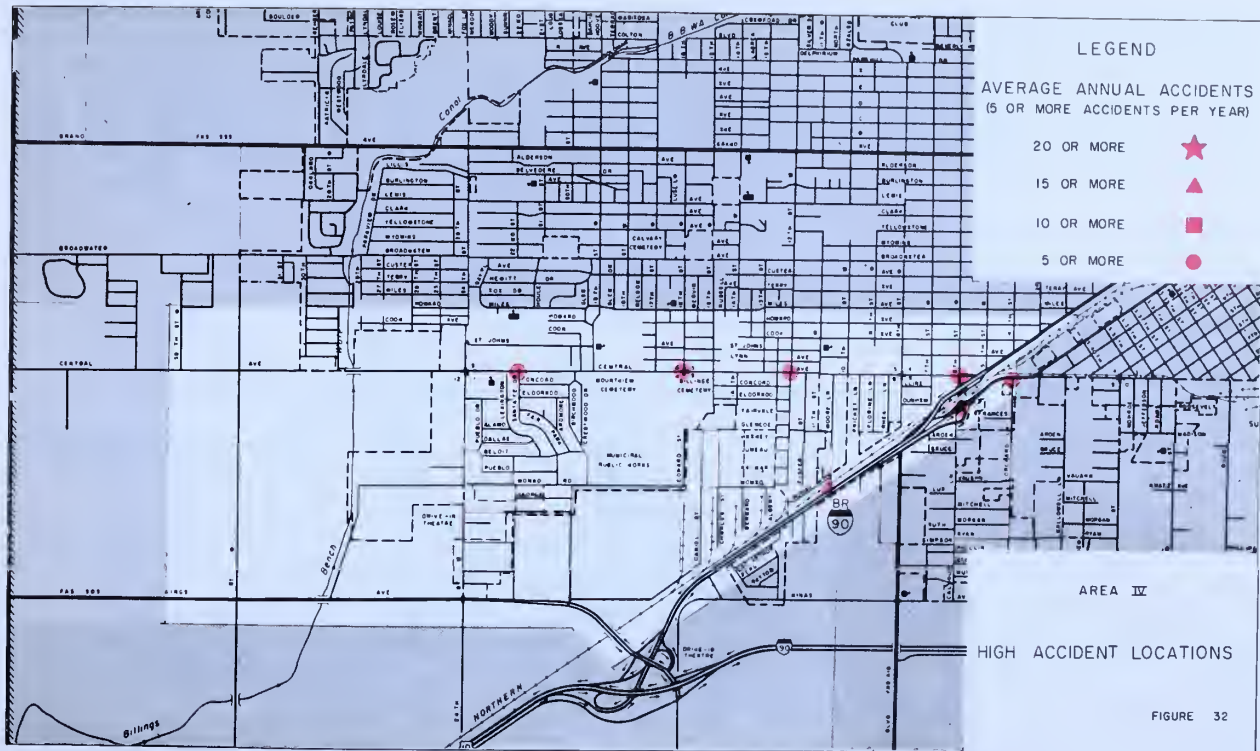
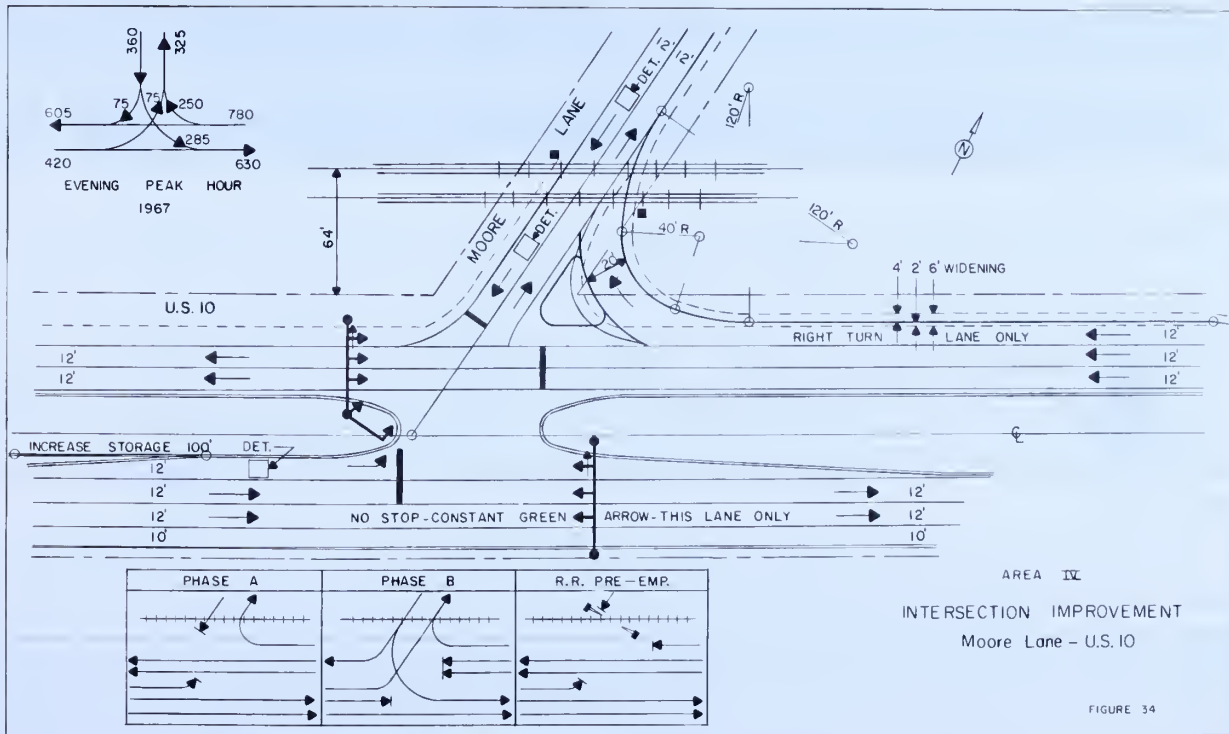


FIGURE 32





BILLINGS TOPICS

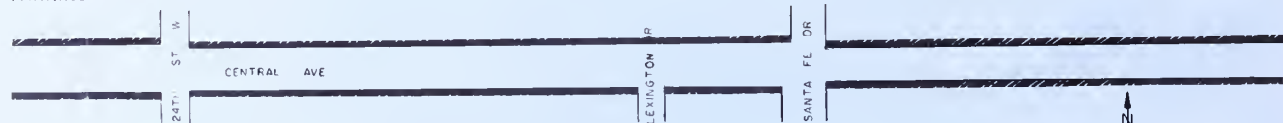
LEGEND

CLASSIFICATION

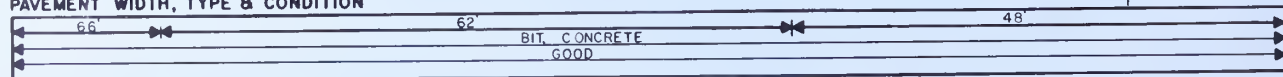
Principal Arterial

NO PARKING

PARKING



PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1969 THRU 1971

ANGLE			2
HEAD-ON			2
REAR-END			1
SIDEWIPED			2
TURNING	3		2
PARKING			2
FIXED OBJECT			1
PEDESTRIAN			1
BACKING			10
MISC.			
TOTAL	3		

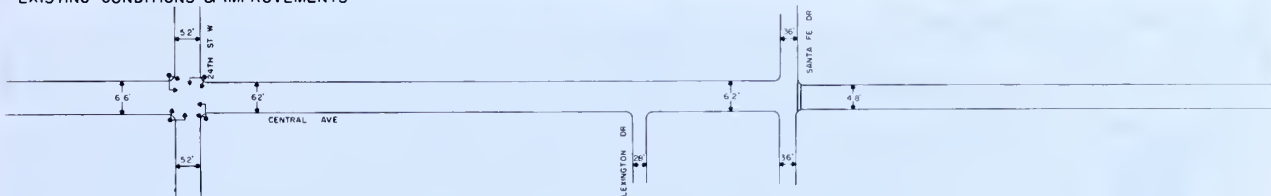
6-1-69 TO 9-30-71

SPEED & DELAY

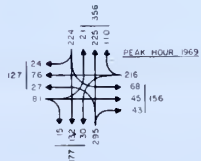




EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE

A	
B	
C	
D	
E	

COSTS

BILLINGS TOPICS

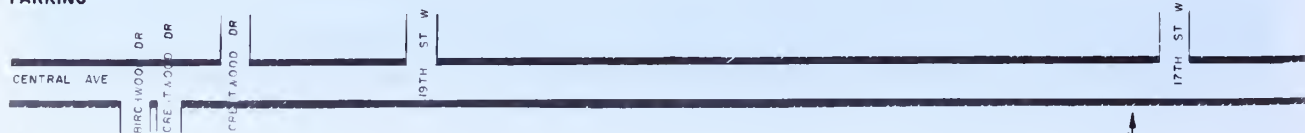
LEGEND

NO PARKING

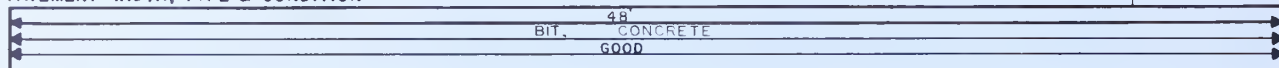
CLASSIFICATION

Principal Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

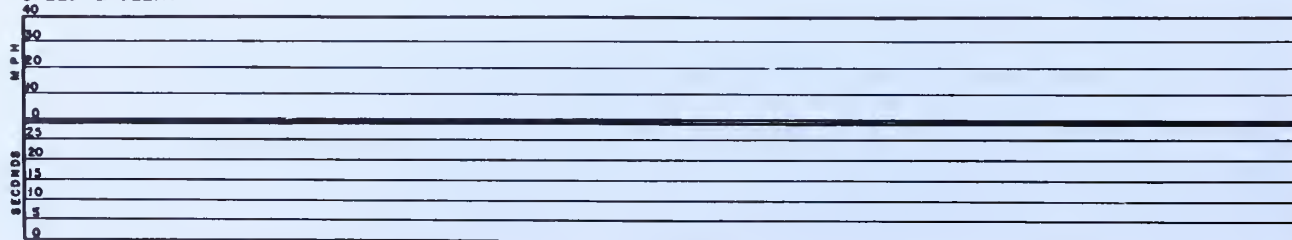


ACCIDENT SUMMARY 1969 THRU 1971

ANGLE				
HEAD-ON				
REAR-END				
SIDE-SWIP				
TURNING	2			
PARKING				
FIXED OBJECT				
PEDESTRIAN				
BACKING				
MISC.				
TOTAL	2	4		2

6-1-69 TO 9-30-71

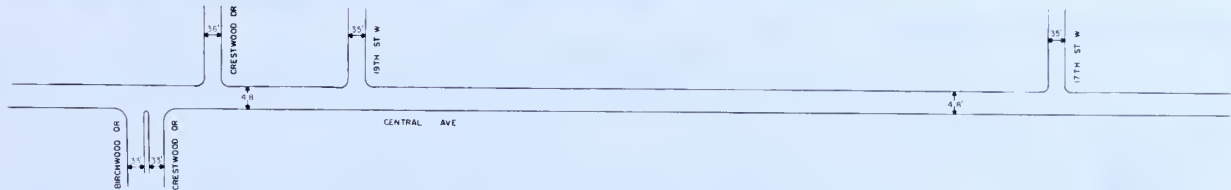
SPEED & DELAY



PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

A	
B	
C	
D	
E	

COSTS

LEGEND

NO PARKING

Principal arterial

An aerial photograph of a city street intersection. The main horizontal street is labeled 'CENTRAL AVE'. A vertical street, 'REGAL ST', runs through the center of the image. To the left of Regal St, there are two more vertical streets labeled '16TH ST W' and '15TH ST W'. To the right of Regal St, there are two more vertical streets labeled '14TH ST W' and '13TH ST W'. A north arrow is located in the lower right quadrant of the map, pointing upwards.

48'
BIT. CONCRETE
GOOD

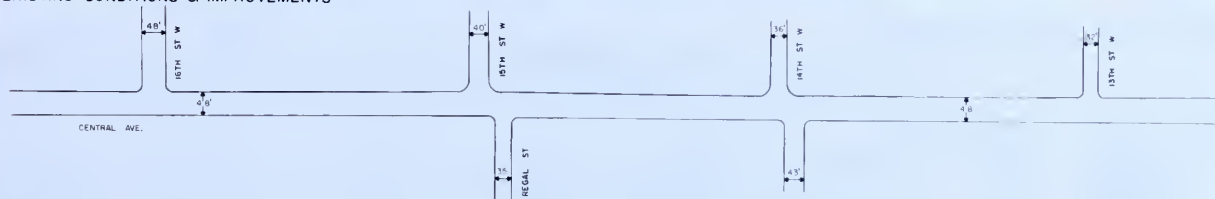
INCIDENT		EXPLANATION		TOTAL		TOTAL	
	ARELY	3		3			
	HEAD-ON						
	REAR-END	3		1			2
	SIDE SWIPE	1					1
	TURNING	4		5			2
	PARKING						
	FIXED OBJECT	1					
	PEDESTRIAN						
	BACKING						
	MISC.						3
TOTAL		12		9		1	8

(69-71)

PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

A	
B	
C	
D	
E	

COSTS

NO PARKING

Abstract

48' 49'

BIT. CONCRETE

GOOD

	ANGLE	2				2														
	HEAD-ON																			
	REAR-END	4		2		2	1			1			2							3
	SIDE-SWIPe																			
	TURNING	2				2	1			1										
	PARKING																			
	FIXED OBJECT																			
	PEDESTRIAN	1											1							1
	BACKING												1							
	MISC.																			
TOTAL		10		2		4	4			2			4							4

6-1-69 TO 9-30-71

A blank graph with a vertical axis labeled "SECONDS" ranging from 0 to 40 in increments of 5, and a horizontal axis labeled "M.E.H.".

PEAK HOUR 1969

620 | 525 ← 554

95 ←

424 → 327 | 416

91 →

97

29

26

186

LEVEL OF SERVICE	
A	ED 0.98
B	
C	
D	
E	

BILLINGS TOPICS

LEGEND

NO PARKING

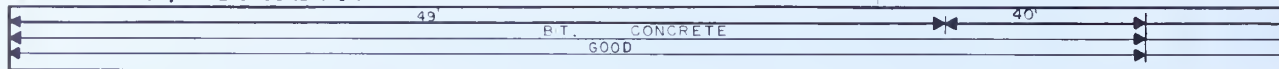
CLASSIFICATION

Principal Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1969 THRU 1971

	ANGLE	1				2		
	HEAD-ON							
	REAR-END	2				1/6	1	
	SIDE SWIPE			1		1		
	TURNING	3		3		10		
	PARKING							
	FIXED OBJECT							
	PEDESTRIAN			1				
	BACKING							
	MISC.							
TOTAL	2	7		5		29	1	2

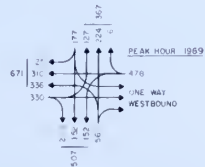
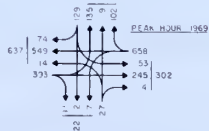
6-1-69 TO 12-31-71

SPEED & DELAY

40	
30	
20	
10	
0	
25	
20	
15	
10	
5	
0	



EXISTING CONDITIONS & IMPROVEMENTS SHOWN IN RED



LEVEL OF SERVICE

A	EB & WB
B	
C	
D	
E	

COSTS

RAMP
\$125,000
TOTAL COST THIS SECTION = \$125,000.00

BILLINGS TOPICS

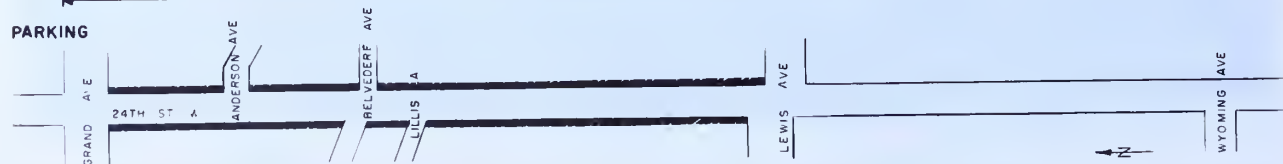
LEGEND

NO PARKING

CLASSIFICATION

Principal Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

48'
BIT. CONCRETE
GOOD

ACCIDENT SUMMARY 1969 THRU 1971

1	ANGLE
1	HEAD-ON
1	REAR-END
	SIDE-SWIPES
2	TURNING
	PARKING
	FIXED OBJECT
	PEDESTRIAN
	BACKING
	MISC.
TOTAL 4	

1-1-70 TO 8-13-70

SPEED & DELAY

MPH	30
	20
	10
	0
SECONDS	25
	20
	15
	10
	5
	0

PEAK HOUR 1969

A B C D E

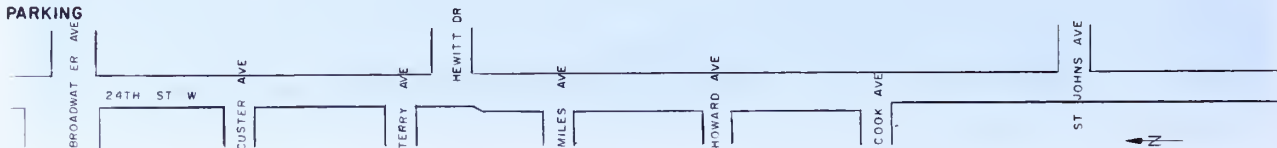
S O B NB-A

BILLINGS TOPICS

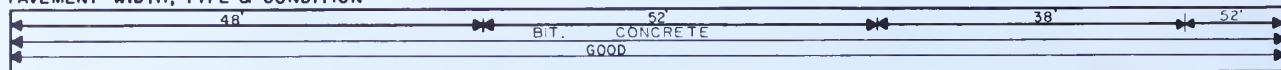
CLASSIFICATION

Principal Arterial

PARKING



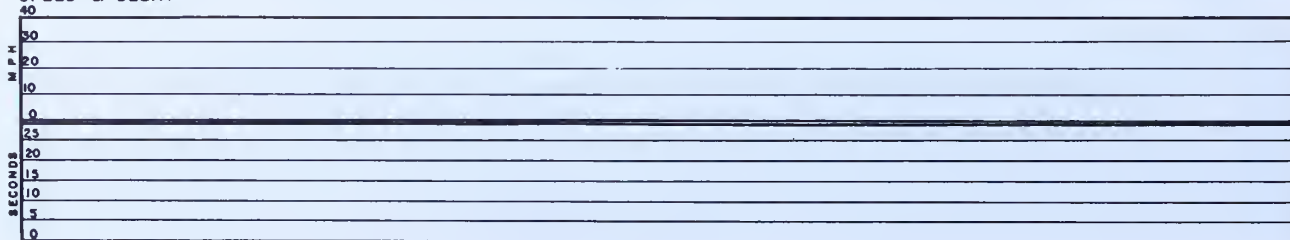
PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1969 THRU 1971

ANGLE	
HEAD-ON	
REAR-END	
SIDE-SWIPE	
TURNING	
PARKING	
FIXED OBJECT	
PEDESTRIAN	
BACKING	
MISC.	
TOTAL	

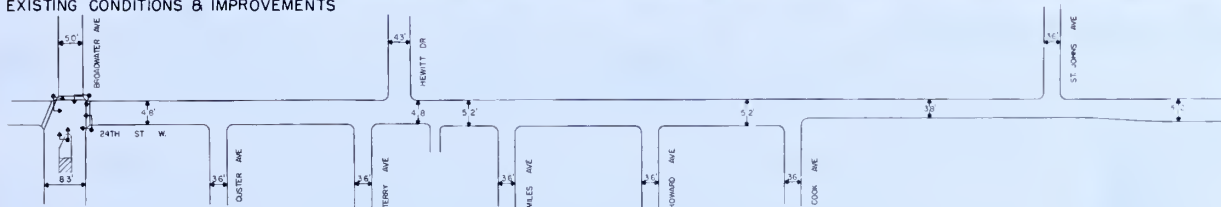
SPEED & DELAY



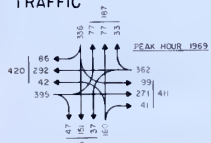
PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE

A	
B	
C	
D	
E	

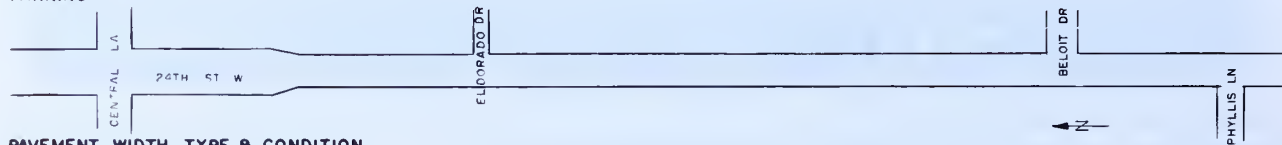
COSTS

BILLINGS TOPICS

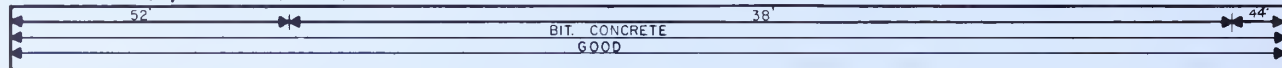
CLASSIFICATION

Principal Arterial

PARKING



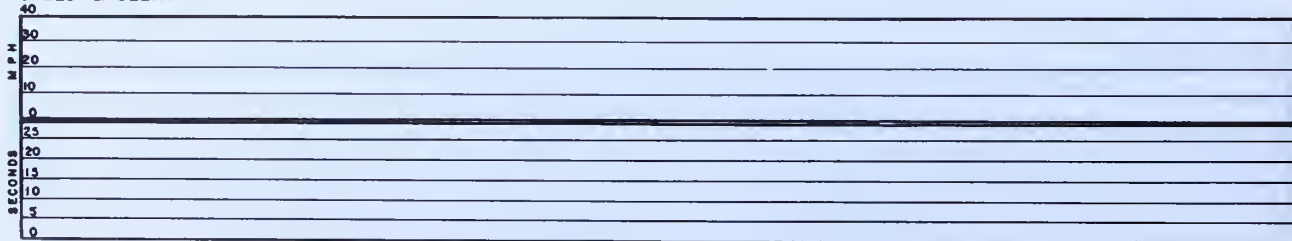
PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1969 THRU 1971

ANGLE	
HEAD-ON	
REAR-END	
SIDE-SWIP	
TURNING	
PARKING	
FIXED OBJECT	
PEDESTRIAN	
BACKING	
MISC.	
TOTAL	

SPEED & DELAY



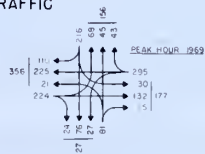
PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE

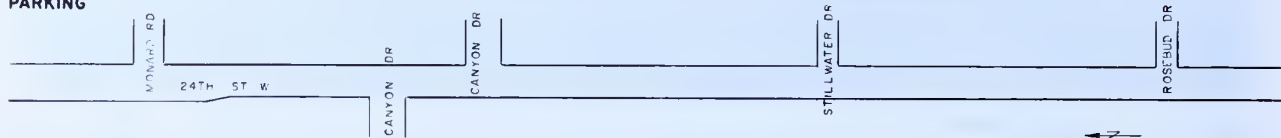
A	
B	
C	
D	
E	

COSTS

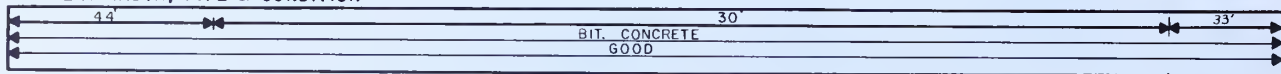
CLASSIFICATION

Principal Arterial

PARKING



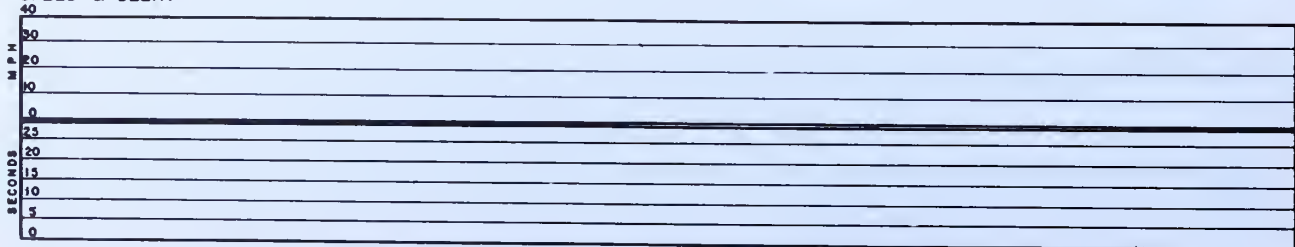
PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1969 THRU 1971

ANGLE	
HEAD-ON	
REAR-END	
SIDESWIPE	
TURNING	
PARKING	
FIXED OBJECT	
PEDESTRIAN	
BACKING	
MISC.	
TOTAL	

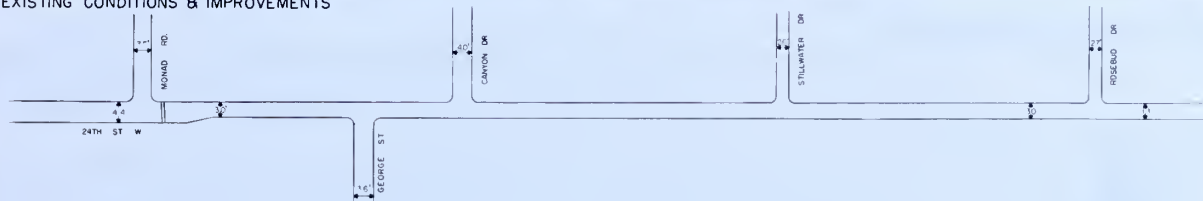
SPEED & DELAY



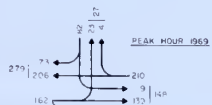
PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

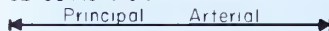


LEVEL OF SERVICE

A	
B	
C	
D	
E	

COSTS

CLASSIFICATION



PARKING



PAVEMENT WIDTH, TYPE & CONDITION

22'	
BIT.	CONCRETE
	GOOD

ACCIDENT SUMMARY 1969 THRU 1971

ANGLE	
HEAD-ON	
REAR-END	
SIDE-SWIP	
TURNING	
PARKING	
FIXED OBJECT	
PEDESTRIAN	
BACKING	
MISC.	
TOTAL	

SPEED & DELAY

40	
30	
20	
10	
0	
25	
20	
15	
10	
5	
0	

PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

A	SR & NR
B	
C	
D	
E	

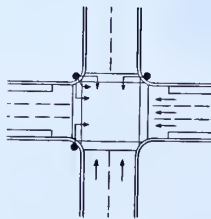
COSTS

AREA IV COST SUMMARY

Location	Intersection Type	Cost
Central Ave.-Montana Ave. Intersection Provide eastbound ramp connection	-	\$125,000
Moore Lane-U.S. 10 Intersection Signalize, revise approach	-	60,000
SUBTOTAL		\$185,000
PLUS 15% Engineering & Contingencies		27,750
ESTIMATED TOTAL COST -- AREA IV		\$212,750

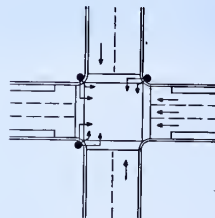
TYPICAL INTERSECTION SITUATIONS FOR COST PURPOSES

TYPE-A



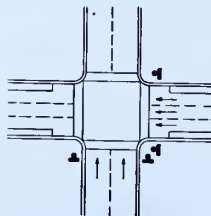
ONE WAY-ONE WAY /
SIGNALIZED

TYPE-B



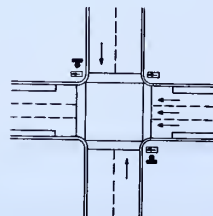
ONE WAY-TWO WAY
SIGNALIZED

TYPE-C



ONE WAY-ONE WAY
SIGNED

TYPE-D



ONE WAY-TWO WAY
SIGNED

AREA V - SOUTHERN CORRIDOR

The area is served by the two minor arterials, State Avenue and 1st Avenue South, and the principal north-south arterial South 27th Street.

South 27th Street functions as a connecting link between I-90 and Montana 3 and is on the Primary Type I System. First Avenue South is also on the Primary Type I System and functions as a minor arterial by providing a truck route around the CBD in an east-west direction. State Avenue is a part of the Primary Type II System.

1st Avenue South and South 27th Street - Recent improvements to both 1st Avenue South and South 27th Street in the form of major reconstruction and traffic control devices have placed the streets in good operating condition. Neither street has a capacity problem. Traffic volumes range from 2,500 to 4,000 vehicles per day on South 27th Street and from 3,000 to 5,000 vehicles per day on 1st Avenue South. Both streets are four-lane facilities and at this time do not indicate a need for TOPICS type improvements.

State Avenue - 1st Avenue South to South 27th Street

Problems - This street functions as a connector between South 27th Street, which provides direct access to I-90, and 1st Avenue South which serves the commercial area flanking the Burlington

Northern tracks. The street also serves as a collector for the residential streets running in a northeasterly direction and also serves the industrial area near the sugar refinery.

The street normally handles 1,000-2,000 vehicles per day except during the sugar beet harvest when a considerable number of commercial type vehicles add to these volumes. A narrow roadway varying between 27 feet - 30 feet and a number of skewed intersections are the two areas of concern at this time. The major intersection at 1st Avenue South has recently been channelized with a new signal installation and appears to be operating well. The eastern terminus of the street does not warrant signals and was improved during the major improvements on South 27th Street.

Capacity - No capacity problems exist at the present time.

Accidents - Other than a scattering of accidents at most intersections, no serious accident problems exist.

Recommended Improvements - Other than a recommendation of major reconstruction to improve the surface and roadway width, no major TOPICS type projects are evident. Minor improvements are indicated on page 199 and 201 of the improvement section.

Evaluation - Because no major problems exist at this time, the recommended improvements are not expected to provide any change in operation of the avenue other than driver information and comfort.

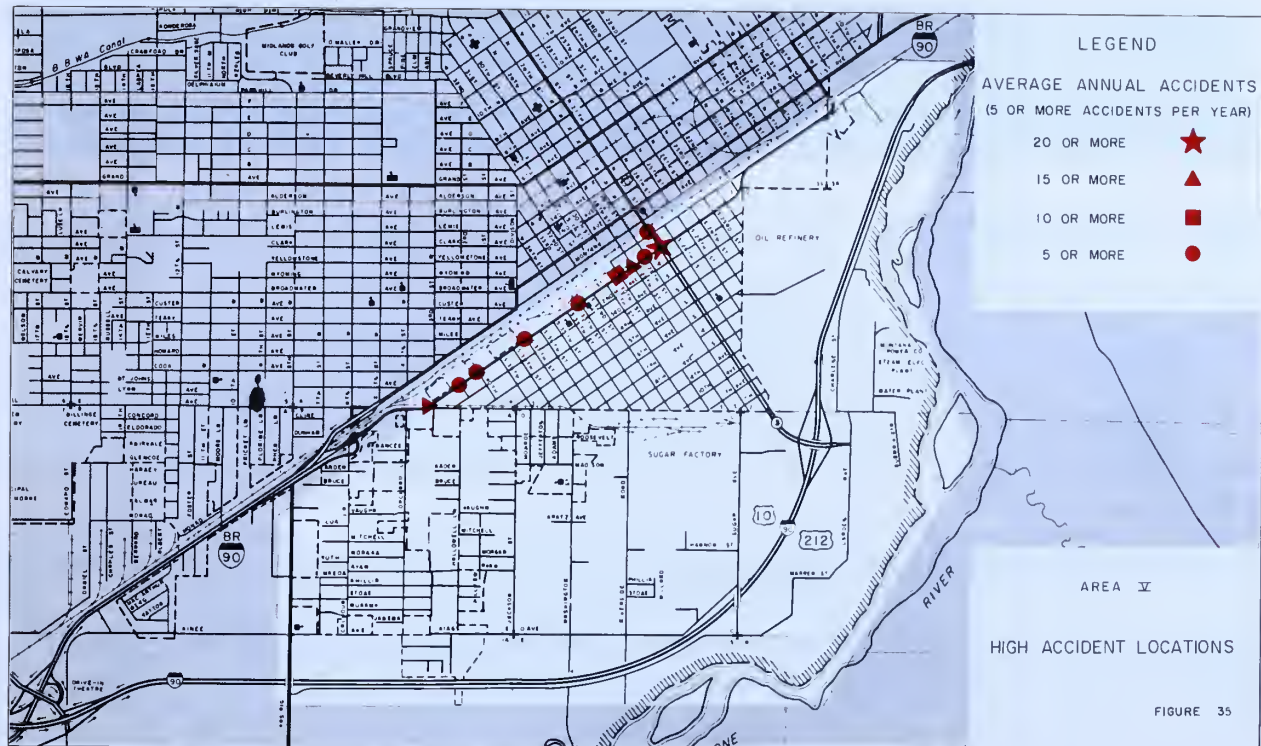


FIGURE 35

BILLINGS TOPICS

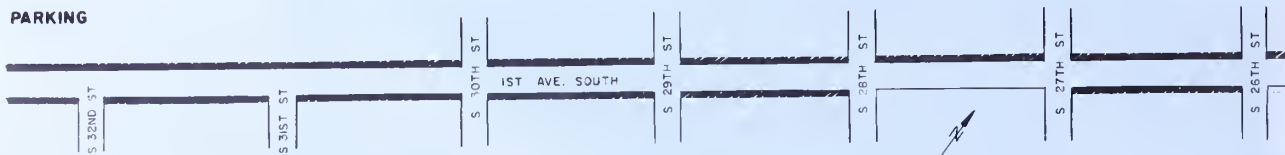
LEGEND

CLASSIFICATION

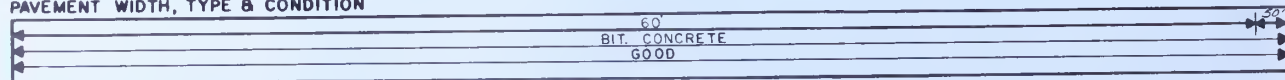
Minor Arterial

NO PARKING

PARKING



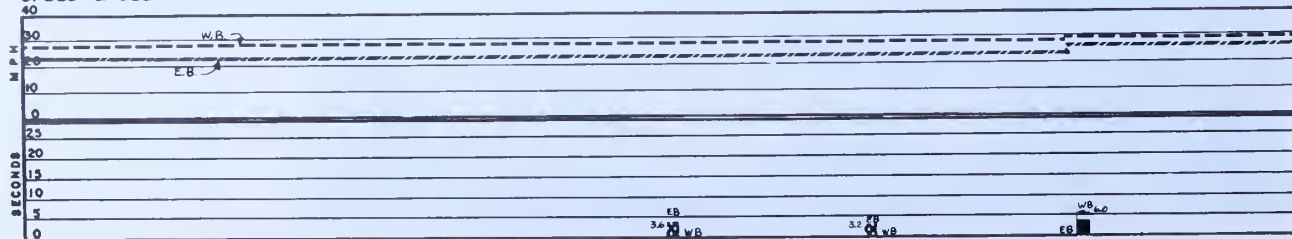
PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1965 THRU 1968

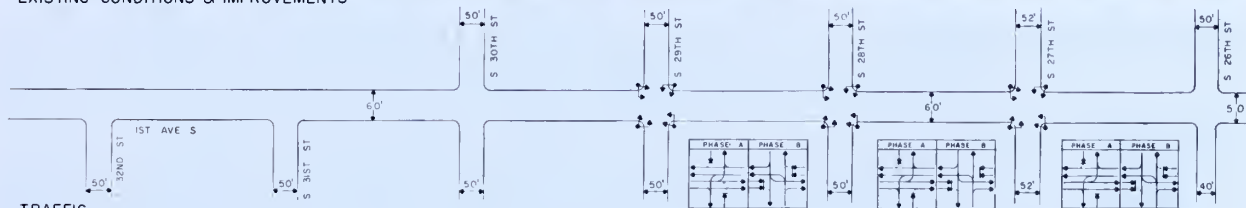
	6	3	11
ANGLE	1	7	13
HEAD-ON	7	2	2
REAR-END	2	10	10
SIDE SWIPE	13	1	
TURNING	1		
PARKING			
FIXED OBJECT			
PEDESTRIAN			
BACKING			
MISC.	1		
TOTAL	31 (66-68)	23 (66-68)	36 (66-68)

SPEED & DELAY

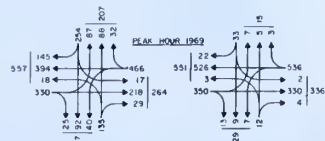




EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE

A	
B	
C	
D	
E	

COSTS

BILLINGS TOPICS

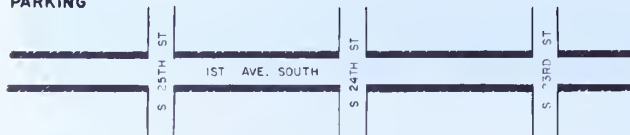
LEGEND

CLASSIFICATION

Minor Arterial

NO PARKING

PARKING



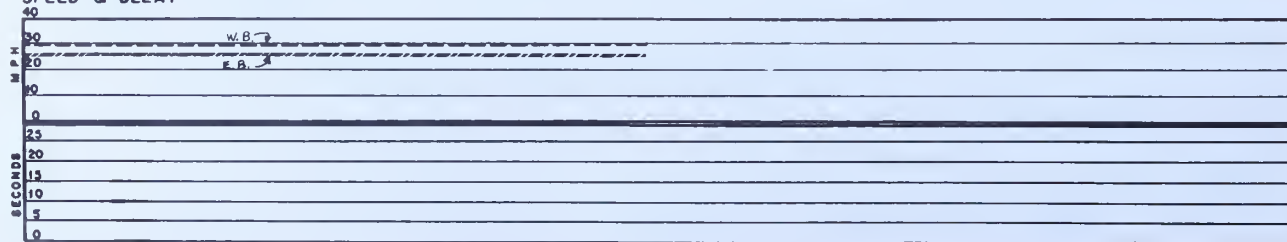
PAVEMENT WIDTH, TYPE & CONDITION

50	
BIT. CONCRETE	
GOOD	

ACCIDENT SUMMARY 1965 THRU 1968

ANGLE	
HEAD-ON	
REAR-END	
SIDE-SWIP	
TURNING	
PARKING	
FIXED OBJECT	
PEDESTRIAN	
BACKING	
MISC.	
TOTAL	

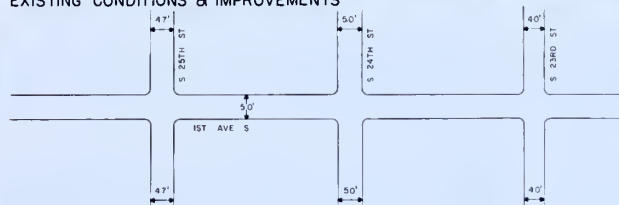
SPEED & DELAY



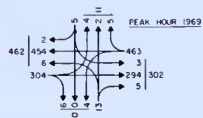
PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE

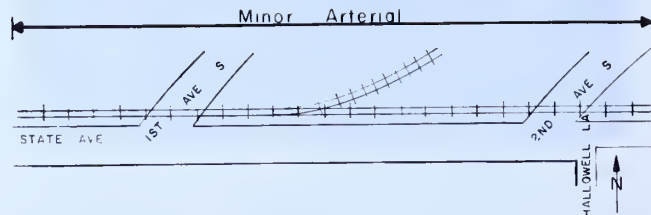
A	
B	
C	
D	
E	

COSTS

BILLINGS TOPICS

CLASSIFICATION

PARKING



PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1969 THRU 1971

ANGLE	2		1	3
HEAD-ON	1			1
REAR-END	12			
SIDE SWIPE	2			
TURNING	5			1
FIXED OBJECT	2			
PEDESTRIAN				
BACKING	1			
MISC.	4			2
TOTAL	29		1	7

1-1-69 TO 9-30-71

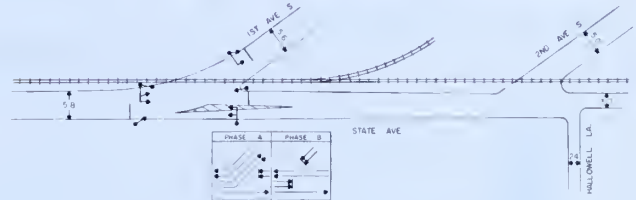
SPEED & DELAY



PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



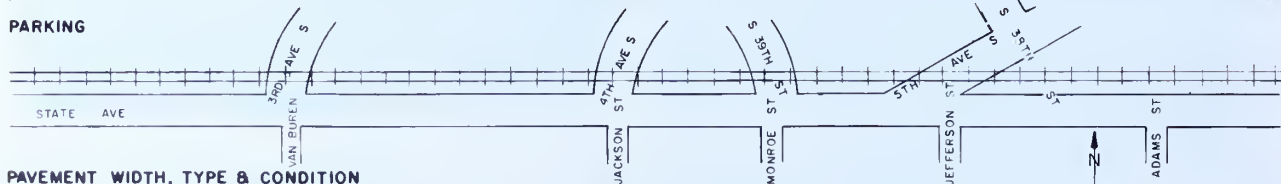
LEVEL OF SERVICE

A	
B	
C	
D	
E	

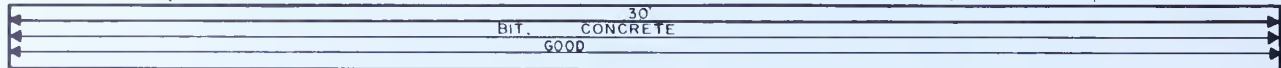
COSTS

Minor Arterial

PARKING



PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1969 THRU 1971

[illegible]

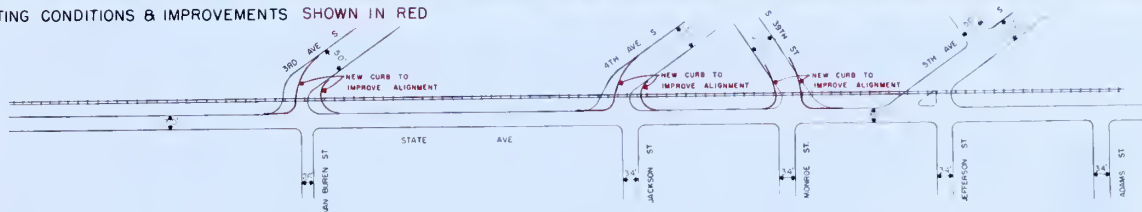
1-1-69 TO 9-30-71

SPEED & DELAY





EXISTING CONDITIONS & IMPROVEMENTS SHOWN IN RED



TRAFFIC

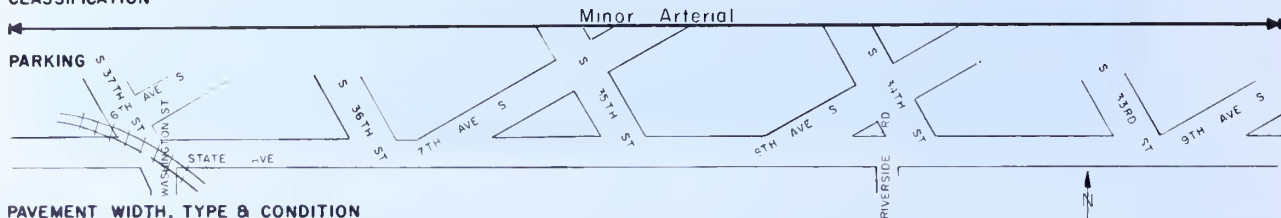
LEVEL OF SERVICE

A	EDAW -
B	
C	
D	
E	

COSTS

\$2000	\$2000	\$2000
TOTAL COST THIS SECTION = \$6000.00		

CLASSIFICATION



PAVEMENT WIDTH, TYPE & CONDITION

30' 27'

BIT. CONCRETE

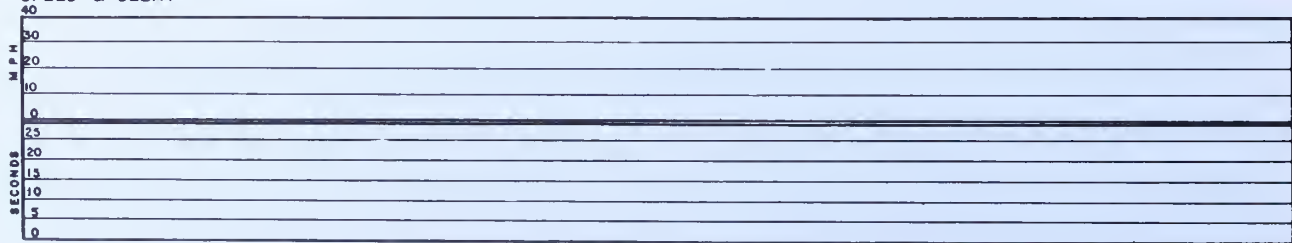
GOOD

ACCIDENT SUMMARY 1969 THRU 1971

	AWSLF	1							1	
	HEAD-ON									
	REAR-END	2		1						
	SIDE SWIPE					1				
	TURNING	1				1			2	
	PARKING									
	FIXED OBJECT					1				
	PEDESTRIAN									
	DACKING									
	MISC.	2	(RR)							
TOTAL		6		1		3			1	2

1-1-69 TO 9-30-71

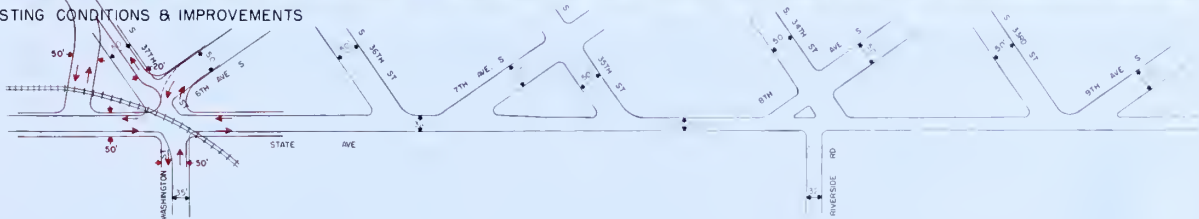
SPEED & DELAY



PLAN VIEW



EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE

1	ED 5.0-6.0
2	
3	
4	
5	

COSTS

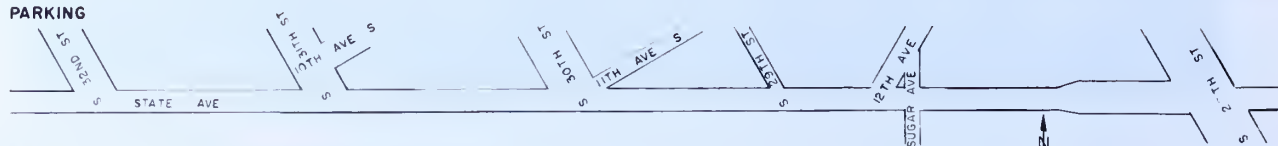
\$ 20,000

BILLINGS TOPICS

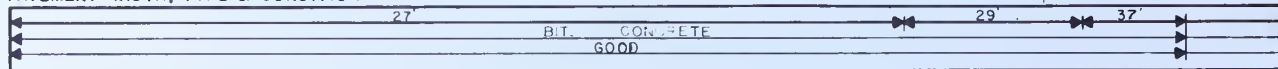
CLASSIFICATION

Minor Arteriol

PARKING



PAVEMENT WIDTH, TYPE & CONDITION

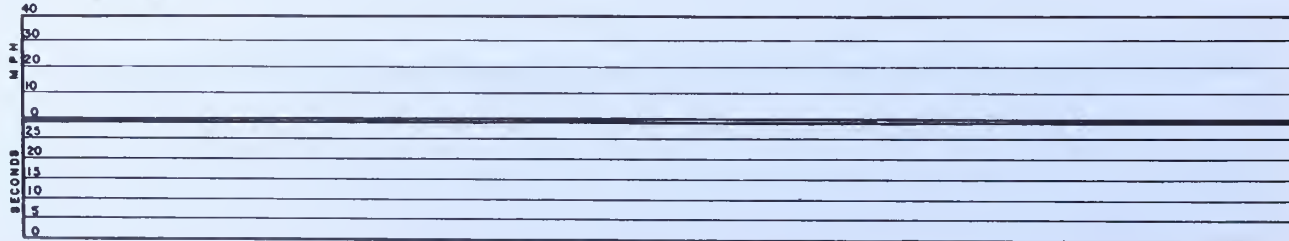


ACCIDENT SUMMARY 1969 THRU 1971

[illegible]

1-1-69 TO 9-30-71

SPEED & DELAY



TRAFFIC

LEVEL OF SERVICE

A

B

C

D

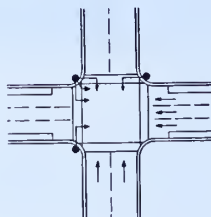
COSTS	

AREA V COST SUMMARY

Location	Intersection Type	Cost
State - Van Buren, Jackson & Monroe Improve street approaches	-	\$ 6,000
State - 6th Ave. South & Washington Improve intersection approach		20,000
SUBTOTAL		\$26,000
PLUS 15% for Engineering & Contingencies		3,900
ESTIMATED TOTAL COST -- AREA V		\$29,900

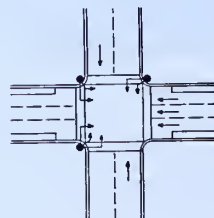
TYPICAL INTERSECTION SITUATIONS FOR COST PURPOSES

TYPE-A



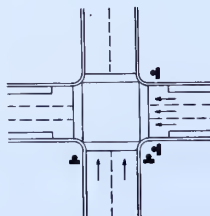
ONE WAY-ONE WAY /
SIGNALIZED

TYPE-B



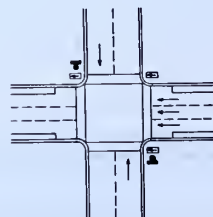
ONE WAY-TWO WAY
SIGNALIZED

TYPE-C



ONE WAY-ONE WAY
SIGNED

TYPE-D



ONE WAY-TWO WAY
SIGNED

AREA VI - NORTHEAST CORRIDOR

U. S. 87-312 is the principal traffic artery of this suburban type extension of greater Billings. From the junction with I-90 Business Route (FAP 16) near the fairgrounds, the highway extends northerly through the built-up area for approximately $2\frac{1}{2}$ miles. Collector and local residential streets feed onto the highway since it provides the only convenient access to the downtown area through the narrow gap between the rimrocks and the river.

The eastern portion of the original townsite is also included in Area VI. This includes portions of the 4th-6th Avenue North couplet and 1st Avenue North.

U. S. 87-312-I 90 Business Route Intersection

Problem - The merging of two high volume arterials has always presented some problems; however, in this particular instance, the location of the main entrance to the fairgrounds has compounded the problem to the extent that the fairground entrance should be moved from the immediate vicinity of the intersection. With the possibility of expanded use of the fairgrounds in the future, it becomes more evident that traffic patterns must be improved.

Capacity - With the exception of fair week, there appears to be no capacity problems with the intersection. Volumes on the Lockwood leg of the intersection may show a decrease in the future when I-90 is complete to Hardin. It is possible that this traffic will be more inclined to make their exit at the 27th Street Interchange, bypassing the Lockwood access to the CBD.

Accidents - The intersection and its approaches has accounted for as many as 17 accidents during a one year period. Although many of the accidents are not correctable through channelization, or signalization alone, it is possible that a complete modernization of the intersection would reduce accidents considerably.

Recommended Improvements - Figure 37 indicates one possibility for improving the operation of the intersection. The scope of this study does not allow for a full investigation of the location,

but, it is evident that the following recommendations should be considered.

1. Remove fairgrounds entrance from direct access to the intersection.
2. Rechannelize the intersection providing left turn refuge where necessary.
3. Update signals accordingly.
4. Provide adequate lighting.

All improvements should also be coordinated with any future planning being done by the fair board.

Evaluation - It is expected that the accident record for this location would be greatly improved with the proposed improvements. Capacity will not be increased to any great extent, but driver comprehension and comfort should increase.

4th Avenue North - North 13th Street Intersection

Problem - Recent implementation of the 4th-6th Avenue North couplet west of this location has caused an increase in traffic through the intersection. North 13th Street and the east end of 4th Avenue North have in the past been part of the truck route and the additional volumes have created concern to both the truckers and local commercial establishments.

Capacity - Capacity is adequate at the present time with the intersection operating at a v/c ratio of 0.60.

Accidents - Existing accident records indicate no serious accident problem at this time. Local businesses in the vicinity, however, have petitioned the Department of Highways for intersection improvements due to a presumed high accident incidence. It is possible that many unreportable accidents under \$250 property damage are occurring and of course, not showing in the accident records.

Recommended Improvements - Minimum vehicle volume warrants for

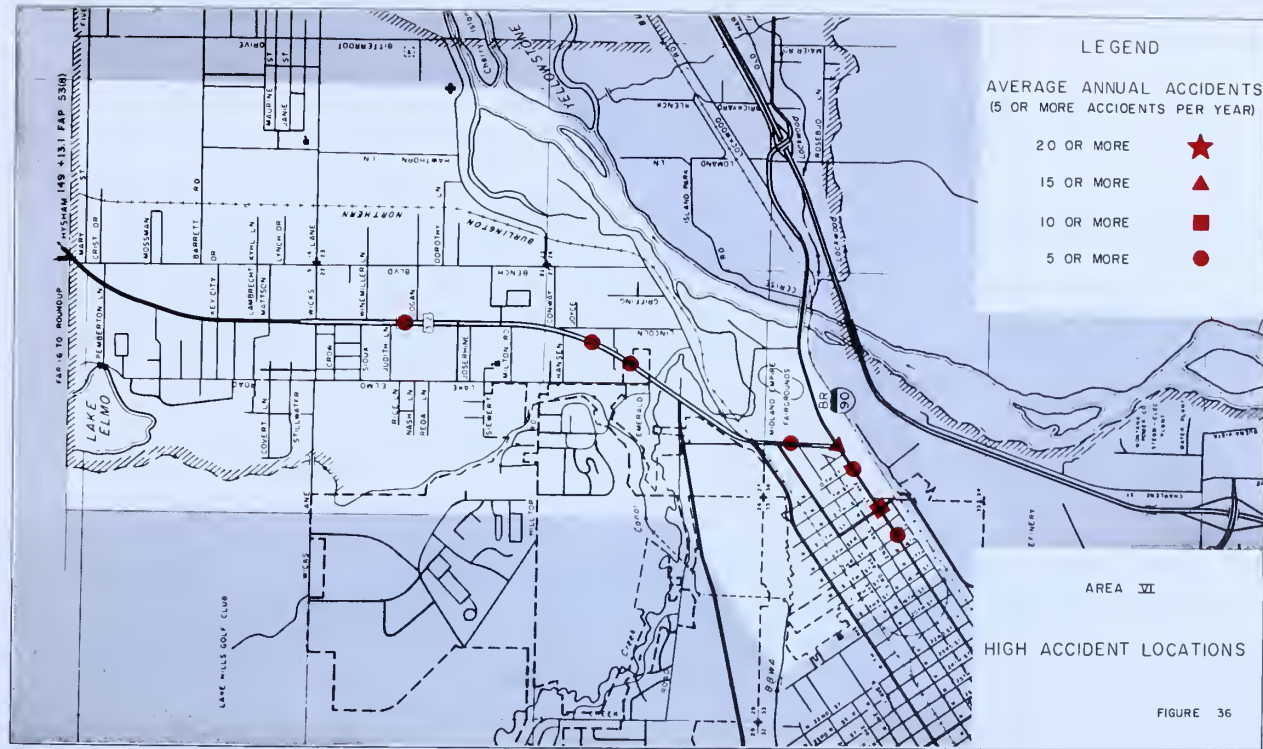
signalization are present and it is recommended that a traffic actuated signal installation be considered.

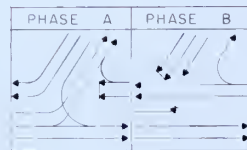
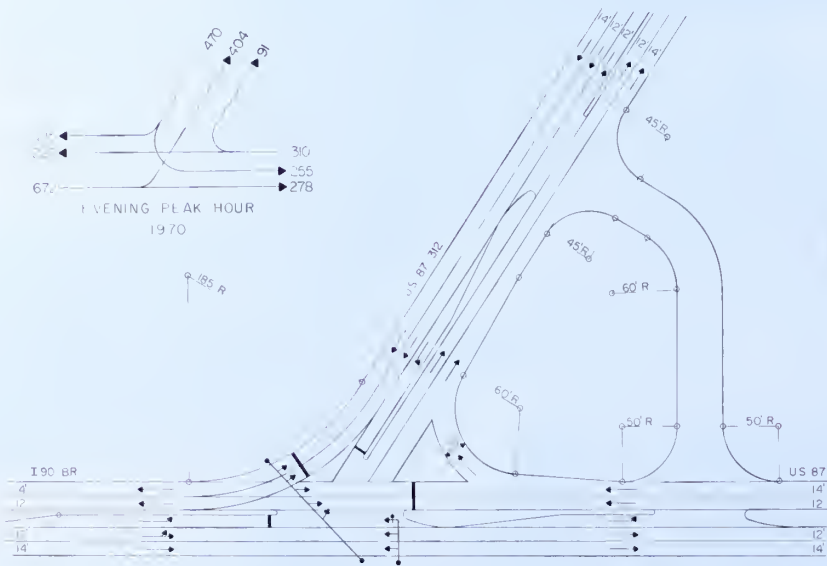
Evaluation - Since it is also a recommendation of the study to extend the 4th-6th Avenue North couplet to Exposition Drive, it is possible that 4th Avenue North will become an eastbound one-way street in the near future. It appears that warrants may still be satisfied since all truck movements will then approach from the side street.

4th-6th Avenue North Couplet - The extension of the 4th-6th Avenue North couplet to Exposition Drive is strongly recommended. Circulation of traffic through the commercial area presents a problem, however, platted streets at one time existed between the two avenues from North 10th Street to the present limits of the couplet at North 20th Street. It appears that it is still physically possible to construct cross streets through on North 16th, 15th, 12th and 11th Streets to provide circula-

tion, see Figure 38. Adequate circulation could be had without the extension of all streets mentioned above, but it would be desirable to have at least North 18th, 15th, 13th and 10th Streets open. A more detailed study of the possibilities in this area are recommended for the specific purpose of improving the circulation.

Traffic volumes on both avenues have been increasing. Most noticeable is the increase of traffic on 4th Avenue North between North 27th Street and Exposition Drive. This would indicate that the avenues are, for the most part, presently functioning as one-ways for their entire length. The 1971 volume counts between North 20th Street and Exposition Drive show 6th Avenue North varying from 6,500 ADT near North 20th Street to 4,700 ADT at Exposition Drive while 4th Avenue North has increased in volume throughout its length and now has an ADT of 9,500 near North 20th Street dropping to 5,600 ADT at Exposition Drive.

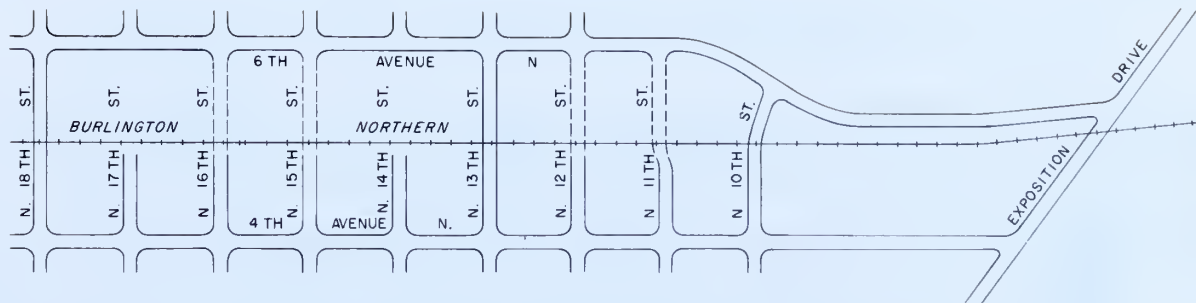




AREA VI

INTERSECTION IMPROVMENT
US 87-312-I90 Business Route

FIGURE 37



——— EXISTING STREETS
 - - - - - PROPOSED STREETS

AREA VI
 EAST EXTENSION 4TH-6TH AVE. N. COUPLET
 SHOWING
 NORTH-SOUTH STREET IMPROVEMENTS
 NECESSARY FOR CIRCULATION

CLASSIFICATION

Principal Arterial

PARKING

F&P 2

EXPOSITION DRIVE

4TH AVE N 3RD

PAVEMENT WIDTH, TYPE & CONDITION

64

BIT. CONCRETE
GOOD

92'

ACCIDENT SUMMARY 1965 THRU 1968

ANGLE
HEAD-ON
REAR-END
SIDE-SWIP
TURNING
PARKING
FIXED OBJECT
PEDESTRIAN
BACKING
MISC.

TOTAL

SPEED & DELAY

40

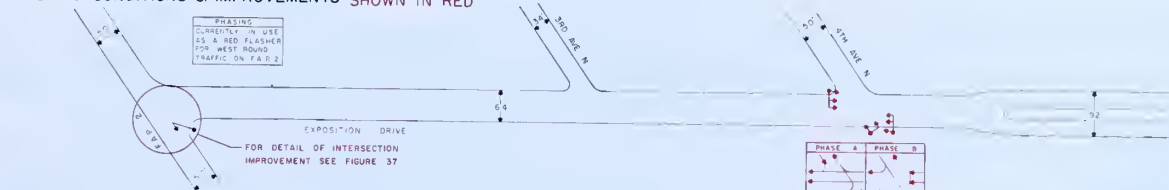
MPH

S.B.

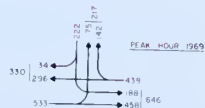
N.B.

SECONDS

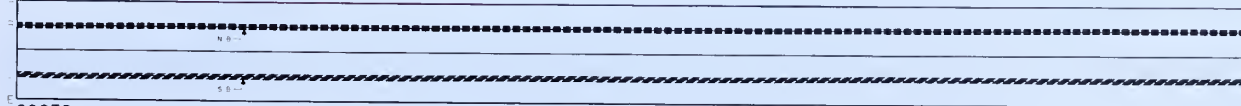
EXISTING CONDITIONS & IMPROVEMENTS SHOWN IN RED



TRAFFIC



LEVEL OF SERVICE



COSTS

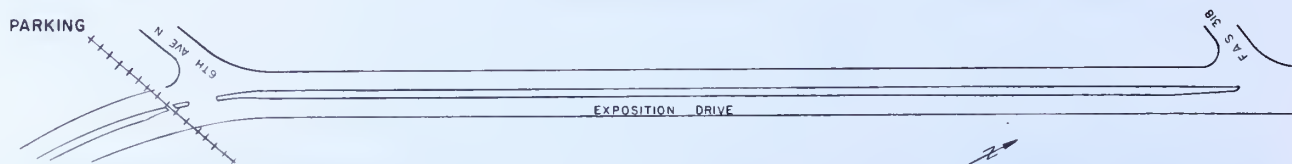
TYPE E	TYPE E
\$50,000	\$14,000
TOTAL COST THIS SECTION = \$64,000	

BILLINGS TOPICS

CLASSIFICATION

Principal Arterial

PARKING



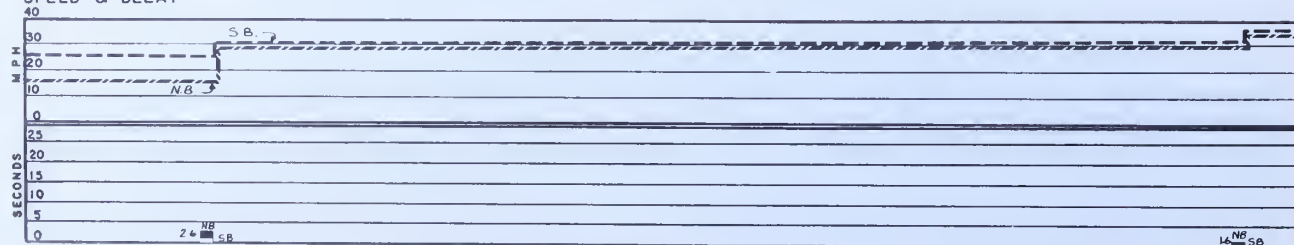
PAVEMENT WIDTH, TYPE & CONDITION

92' Section with 24' Curbed Median
BIT. CONCRETE
GOOD

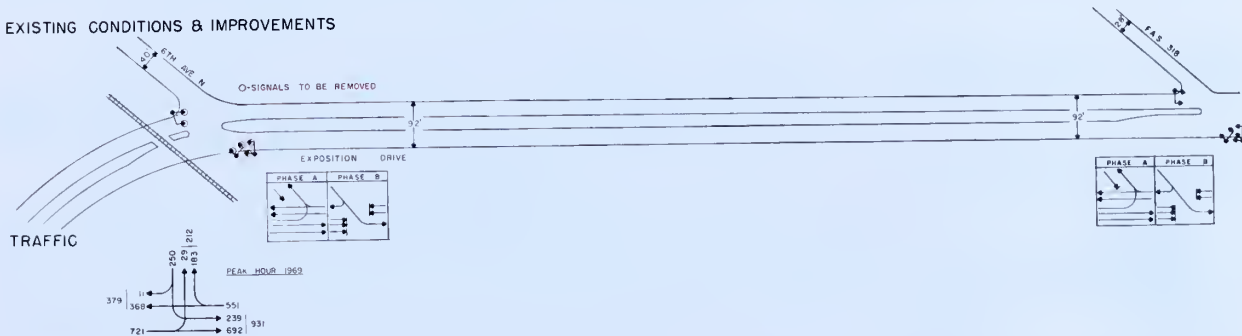
ACCIDENT SUMMARY 1965 THRU 1968

ANGLE
HEAD-ON
REAR-END
SIDE SWIPE
TURNING
PARKING
FIXED OBJECT
PEDESTRIAN
BACKING
MISC.
TOTAL

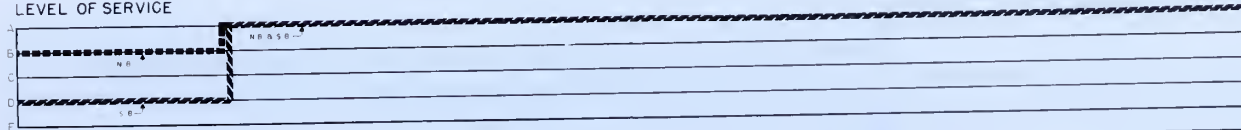
SPEED & DELAY



EXISTING CONDITIONS & IMPROVEMENTS



LEVEL OF SERVICE



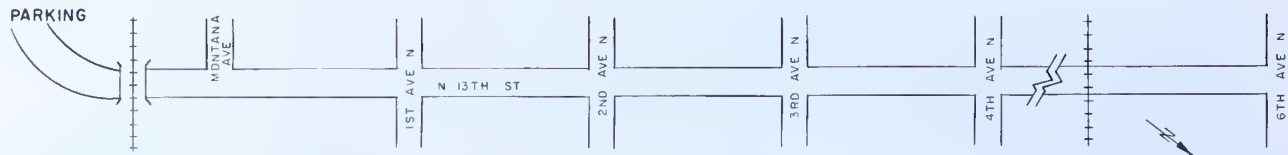
COSTS

BILLINGS TOPICS

CLASSIFICATION

Minor Arterial

Local Street



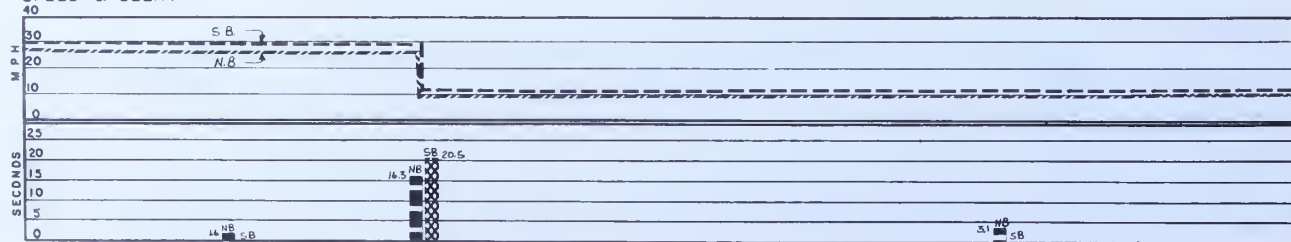
PAVEMENT WIDTH, TYPE & CONDITION

46'
BIT. CONCRETE
GOOD

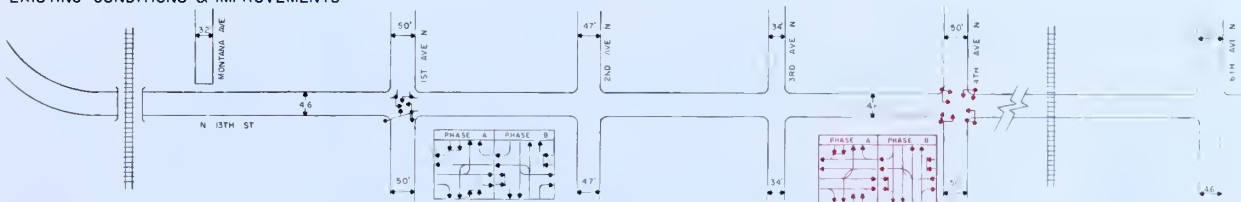
ACCIDENT SUMMARY 1965 THRU 1968

ANGLE
HEAD-ON
REAR-END
SIDE SWIPE
TURNING
PARKING
FIXED OBJECT
PEDESTRIAN
BACKING
MISC.
TOTAL

SPEED & DELAY



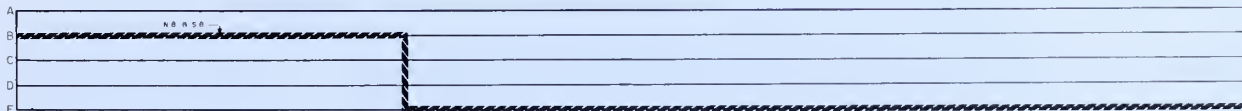
EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE



COSTS

		TYPE E
		\$15,000
		TOTAL COST THIS SECTION - \$15,000

BILLINGS TOPICS

LEGEND

CLASSIFICATION

Minor Arterial

NO PARKING
METERED PARKING
RESTRICTED PARKING



PARKING



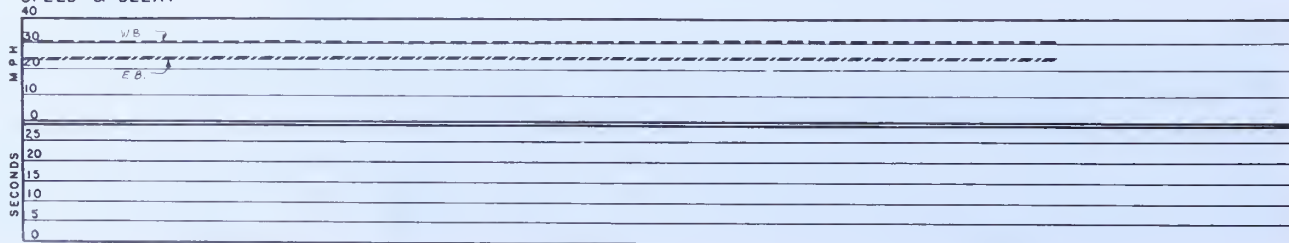
PAVEMENT WIDTH, TYPE & CONDITION

50'
BIT. CONCRETE
GOOD

ACCIDENT SUMMARY 1965 THRU 1968

ANGLE
HEAD-ON
REAR-END
SIDE SWIPE
TURNING
PARKING
FIXED OBJECT
PEDESTRIAN
BACKING
MISC.
TOTAL

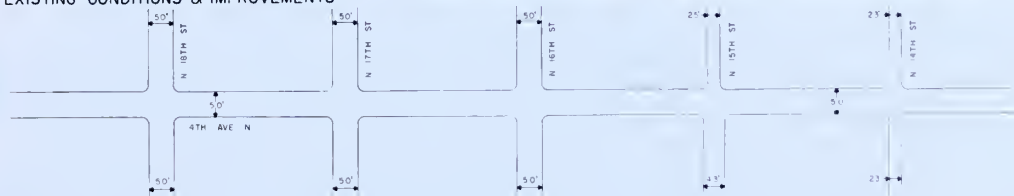
SPEED & DELAY



PLAN VIEW

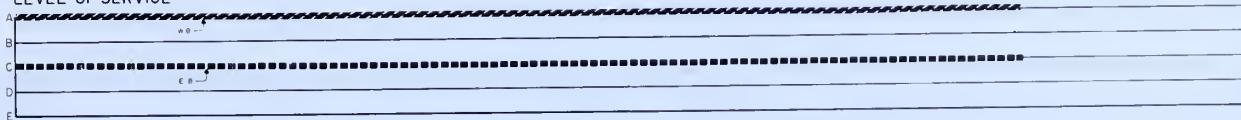


EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC

LEVEL OF SERVICE



COSTS

BILLINGS TOPICS

LEGEND

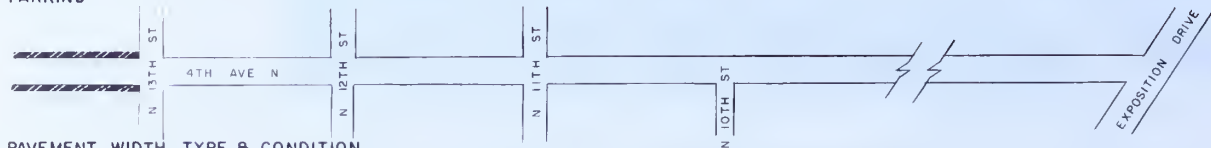
NO PARKING
METERED PARKING
RESTRICTED PARKING



CLASSIFICATION

Minor Arterial

PARKING



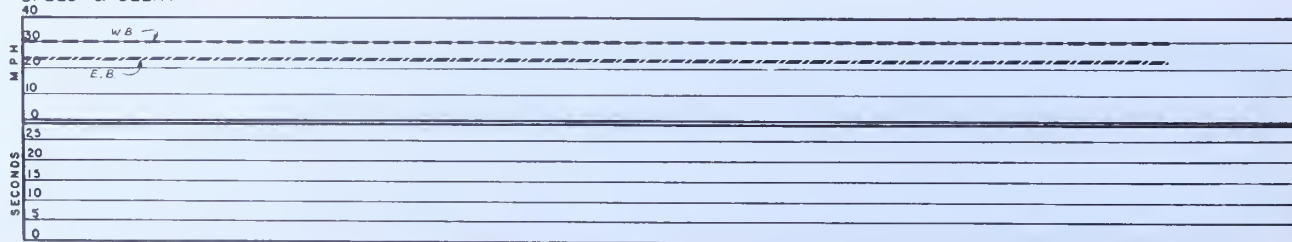
PAVEMENT WIDTH, TYPE & CONDITION

50'
BIT. CONCRETE
GOOD

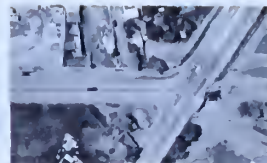
ACCIDENT SUMMARY 1965 THRU 1968

ANGLE	
HEAD-ON	
REAR-END	
SIDESWIPE	
TURNING	
PARKING	
FIXED OBJECT	
PEDESTRIAN	
BACKING	
MISC.	
TOTAL	

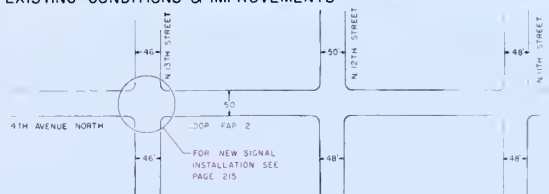
SPEED & DELAY



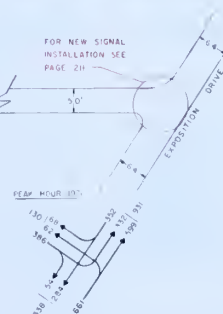
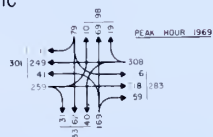
PLAN VIEW



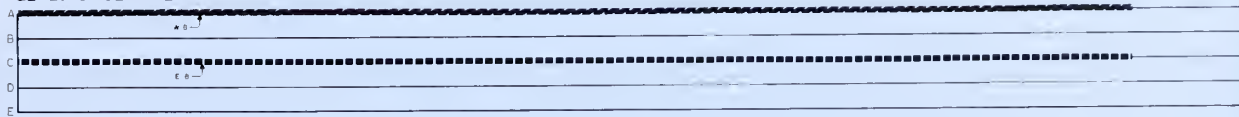
EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE



COSTS



BILLINGS TOPICS

LEGEND

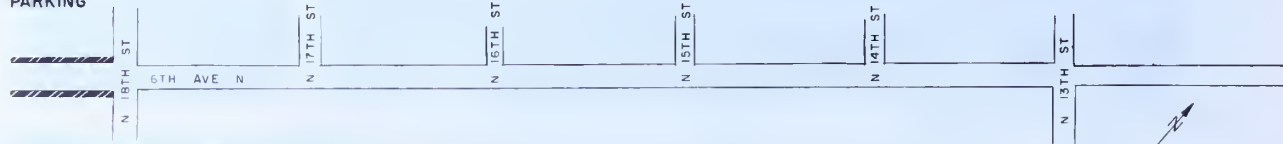
NO PARKING
METERED PARKING
RESTRICTED PARKING



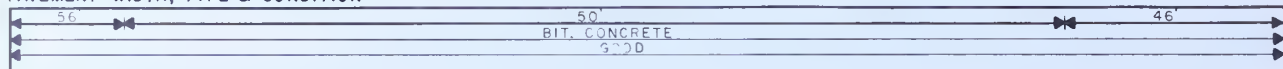
CLASSIFICATION

Minor Arterial

PARKING



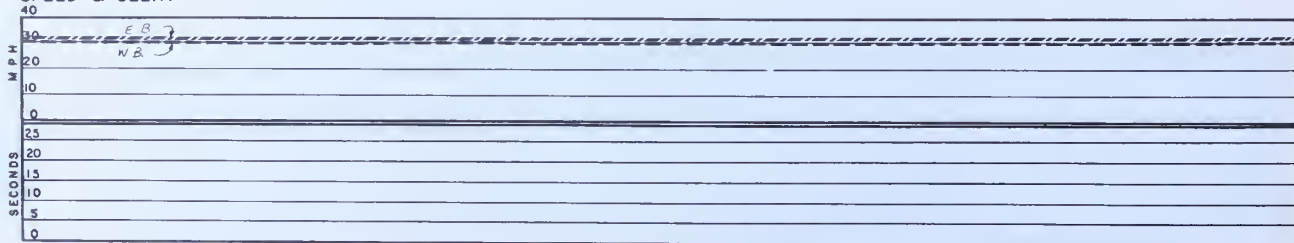
PAVEMENT WIDTH, TYPE & CONDITION

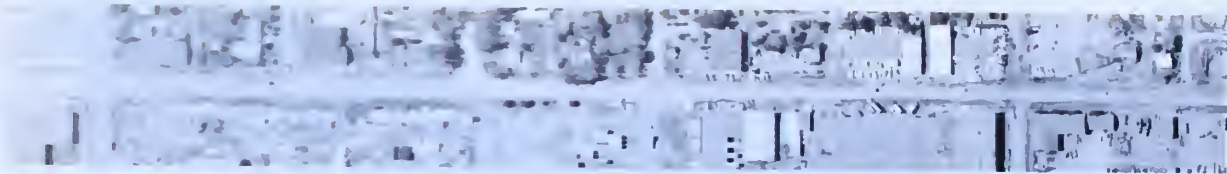


ACCIDENT SUMMARY 1965 THRU 1968

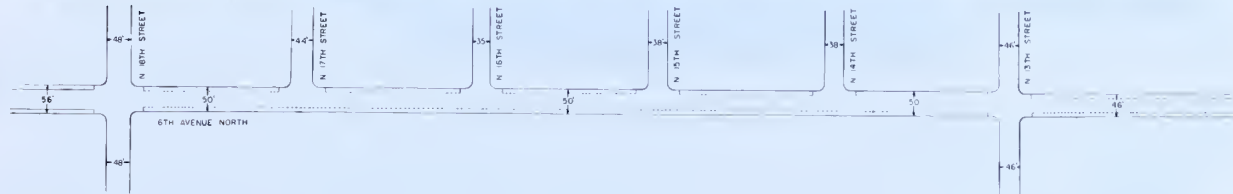
ANGLE
HEAD-ON
REAR-END
SIDE-SWIPES
TURNING
PARKING
FIXED OBJECT
PEDESTRIAN
BACKING
MISC.
TOTAL

SPEED & DELAY

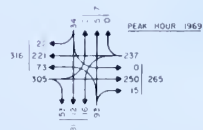




EXISTING CONDITIONS & IMPROVEMENTS



TRAFFIC



LEVEL OF SERVICE

A	
B	
C	
D	
E	

COSTS

BILLINGS TOPICS

LEGEND

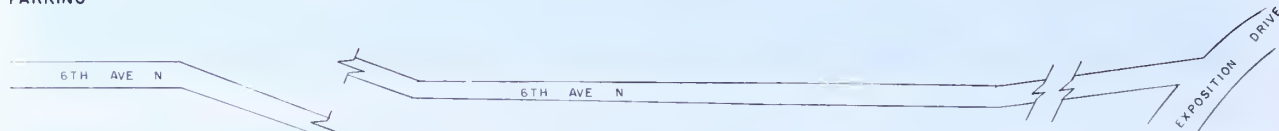
NO PARKING
METERED PARKING
RESTRICTED PARKING



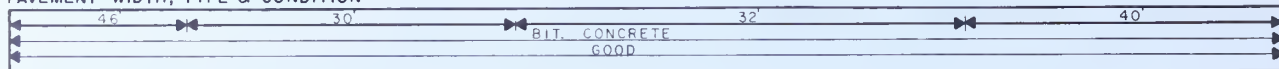
CLASSIFICATION

Minor Arterial

PARKING



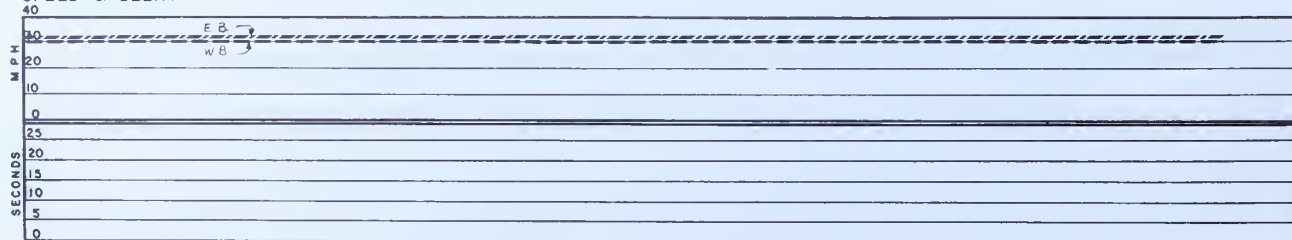
PAVEMENT WIDTH, TYPE & CONDITION



ACCIDENT SUMMARY 1965 THRU 1968

ANGLE
HEAD-ON
REAR-END
SIDESWIPE
TURNING
PARKING
FIXED OBJECT
PEDESTRIAN
BACKING
MISC.
TOTAL

SPEED & DELAY



[illegible]

A
B
C
D
E

CROWD

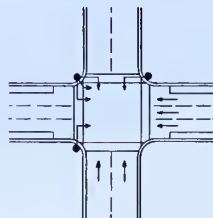
COSTS	

AREA VI COST SUMMARY

Location	Intersection Type	Cost
Exposition Drive-1st Ave. North Improve Fairgrounds Entrance and Channelize Intersection	-	\$50,000
Exposition Drive-4th Ave. North New Signal		14,000
N. 13th Street-4th Ave. North New Signal		15,000
4th-6th Ave. North Implement one-way couplet (Stage One Only)		7,100
SUBTOTAL		\$86,100
PLUS 15% Engineering & Contingencies		12,915
ESTIMATED TOTAL COST -- AREA VI		\$99,015

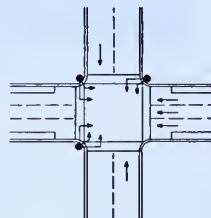
TYPICAL INTERSECTION SITUATIONS FOR COST PURPOSES

TYPE-A



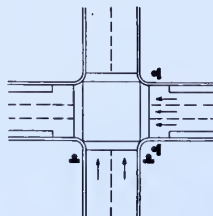
ONE WAY-ONE WAY /
SIGNALIZED

TYPE-B



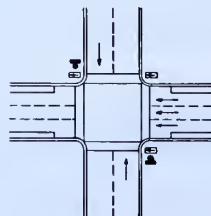
ONE WAY-TWO WAY
SIGNALIZED

TYPE-C



ONE WAY-ONE WAY
SIGNED

TYPE-D



ONE WAY-TWO WAY
SIGNED

AREA VII - EAST CORRIDOR

I-90 and U. S. 87 provide the major traffic movements through this area. U. S. 87 is presently carrying I-90 traffic between Billings and Hardin which makes the Lockwood Interchange a key location as far as existing and future traffic patterns are concerned. All traffic to and from the south presently uses the crossroad at the interchange. With the completion of the inter-

state, such traffic will not be forced to use the crossroad, or U. S. 87 and may find it more convenient to make their Billings entrance-exit at the 27th Street interchange.

Since all grading on I-90 is complete and the surfacing is expected to be complete in the latter part of 1972, it is recommended that this area be reevaluated for possible TOPICS projects after the interstate is open and traffic patterns have stabilized.

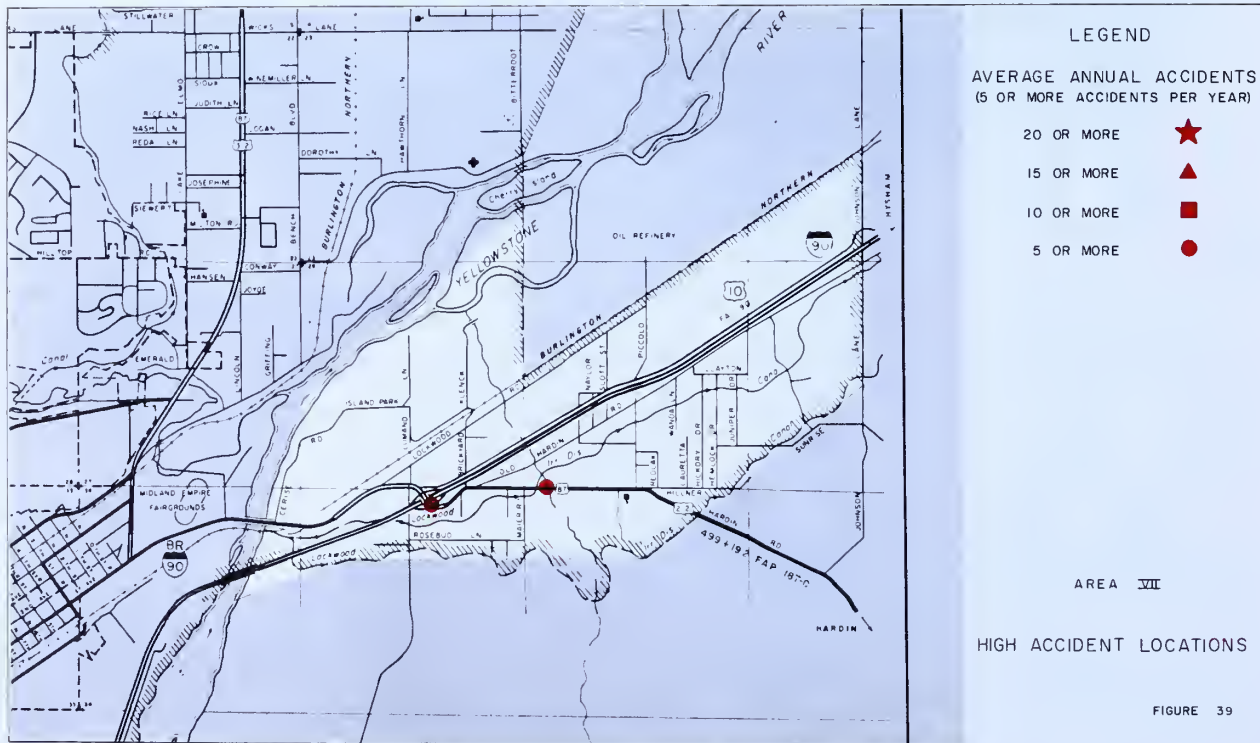


FIGURE 39

EA SYSTEM REVIEW

The recent advent of the Urban System required a number of changes in the Primary Type I, Type II and the Secondary Systems. Figure 40 indicates the extent of the recently approved urban system and also indicates a revised TOPICS system.

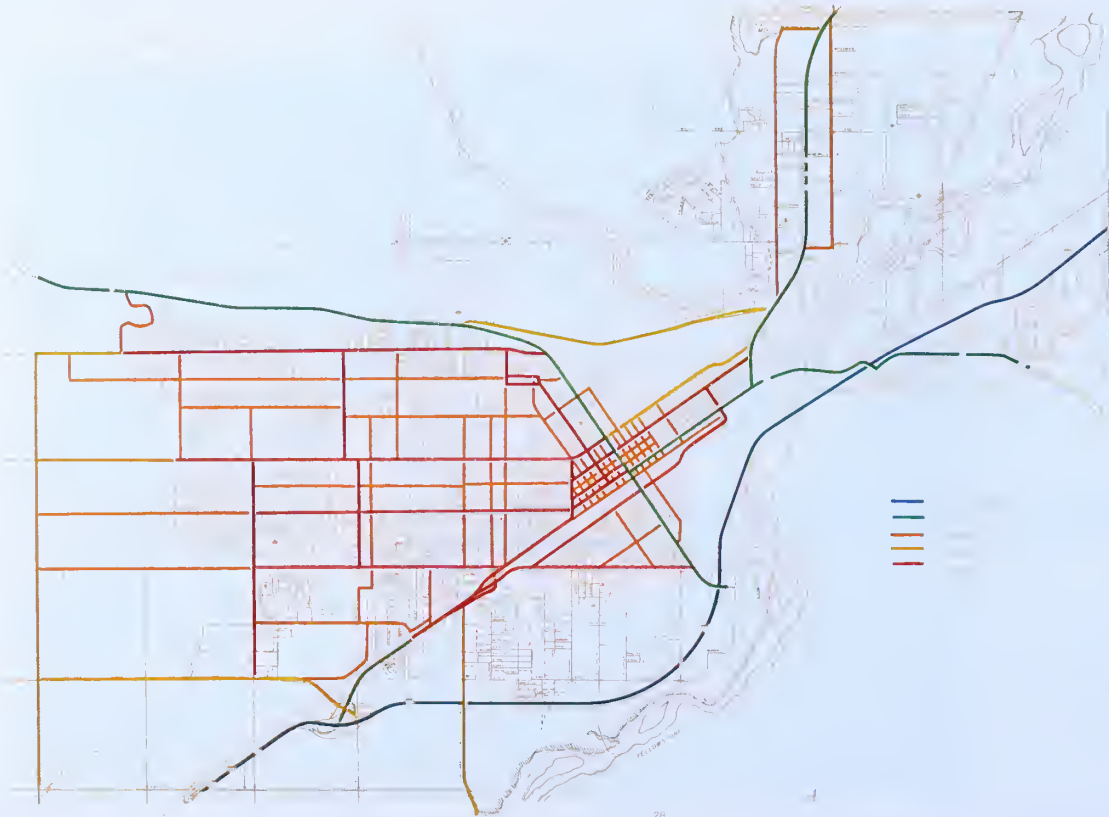
Fourth Avenue North and Sixth Avenue North have been included in the Urban System as far east as North 27th Street. From North 27th Street easterly, Fourth Avenue North continued on the Urban System but Sixth Avenue North was retained as part of FAS Route 535. Because the two streets are operating as one way couplets east of North 27th Street, it is recommended that both streets be placed on the Federal Aid Secondary System.

During the course of the study, it became obvious that many of the streets designated on the tentative TOPICS system would not benefit from the limited type of improvements eligible for TOPICS funds. Many of the streets had low traffic volumes, few accidents, if any, and suffered more from the lack of complete reconstruction than from the absence of minor traffic improvements. Where potential development of a street appeared to be limited, it is recommended that such streets be removed from the system at this time.

Other system changes for the Primary Type I and the Secondary System have been studied in conjunction with the designation of the urban system. For that reason, no additional changes are recommended in this study.

The following streets are recommended for deletion from the TOPICS system.

<u>East - West</u>	<u>Miles Remove</u>
Mary Street	1.00
Wicks Lane (East & West Extensions)	1.30
Kings Avenue	3.00
South Frontage Road	2.05
Warren Street	0.72
Garden Avenue	0.50
Old Hardin Road	1.50
Johnson Lane	1.00
<u>North - South</u>	<u>Miles Remove</u>
Bitterroot Drive	2.46
Jackson Street	1.00
Orchard Lane	1.00
Riverside Road	1.00
Frontage Road (Lockwood)	1.56
Piccolo Street	0.35
No Name Street	0.36
Sugar Avenue	1.00
TOTAL MILES RECOMMENDED FOR REMOVAL	19.80
BALANCE OF TYPE II SYSTEM	47.9 Miles



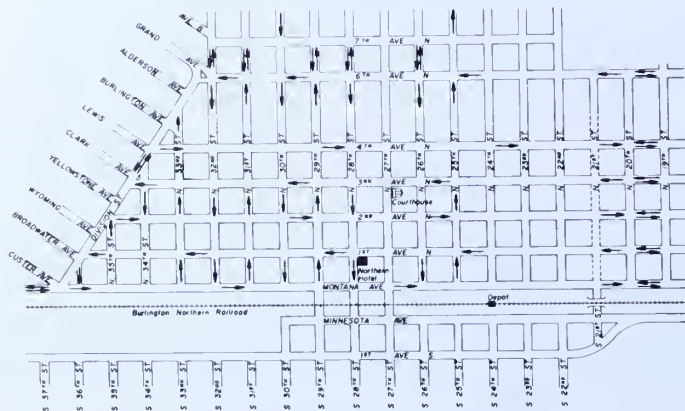
URBAN AREA COST SUMMARY

AREA I	\$534,118
AREA II	114,195
AREA III	318,550
AREA IV	212,750
AREA V	29,900
AREA VI	99,015
AREA VII	NO COSTS
URBAN AREA TOTAL	\$1,308,528

The circulation plan as shown here has been officially adopted by the City Council. The plan follows the long range concept of providing a north-south couplet across the railroad on 25th and 30th Streets. The plan also fits into the core area concept as outlined in the "Gruen Plan".

North-south one-ways have been extended to Division Street on the west and to North 24th Street on the east. This is a preferred situation since it provides more continuity to the one-way system and lessens driver confusion.

Twenty-seventh Street will remain as a two-way major arterial until the structures on North 25th and North 30th Streets become a reality. The recommended improvements on North 27th Street contained in this study should provide mobility to the system during the interim period while the long range plan is being developed.



AREA I

ADOPTED CIRCULATION PLAN

FIGURE 41

PROJECTS BY PRIORITY LISTING AS DESIGNATED BY CITY-COUNTY

1. Poly Drive	Intersection improvement Poly-Grandview-Virginia Lane (Contract Awarded)	\$ 45,000	13. Exposition Drive	Intersection Improvement Including Fairgrounds approach	\$ 50,000+
2. 4th-6th Avenue N.	New signals, Interconnect Division to N. 29th St. (Contract Awarded)	170,000	14. 4th-6th Avenue North	Implement East Section of one- way couplet North 20th St. to Exposition Drive	7,100
3. 4th Avenue N.	Exposition Drive at 4th North Signalization (Contract Awarded)		15. 4th Avenue North	New signal installation North 13th Street	15,000
4. North 31st thru North 36th Street	Implement couplet from Montana Avenue to 6th Avenue North	15,000	16. Grand Avenue	Upgrade signal system Division to 24th St. West	55,000
5. Broadwater Avenue	Widen Roadway 12th - 14th Sts. West	55,000	17. Rimrock Road	Intersection Improvement Rimrock Road-North 27th St.	20,000
6. 27th Street	Widen Roadway 1st Avenue S. to 1st Avenue N.	75,000	18. State Avenue	Improve Intersection State & Washington	20,000
7. Broadwater Avenue	Intersection Improvement 16th Street West	12,000	19. 5th Avenue West	Widen Roadway, Parkhill Drive North + 200'	30,000
8. Montana - 1st Avenue North	Implement couplet from Division to North 19th St.	128,550	20. Broadwater Avenue	Improve Transition at Parkview Drive	7,500
9. Moore Lane	Improve Intersection U.S. 10 (or I-90 Business)	60,000	21. Broadwater - Cuater Avenue	Implement Couplet Division	7,500
10. Lewis Avenue	Intersection Improvement 8th Street West	95,000	22. Poly Drive	Implement 4 - lanes Virginia Lane to 17th Street W.	4,000
11. Central Avenue	Provide Ramp Connection to Montana Avenue	125,000	NOTE: The following projects were not assigned a priority:		
12. North 30th Street	Upgrade to arterial status 6th Avenue N. to Poly Drive	30,900	2nd - 3rd Avenue N.	Implement couplet	55,400
			North 28th -29th and 30th Streets	Implement into one-way couplet system	Cost included in E-W implementation

TOPICS PROGRAM
EVALUATION PROCEDURES FOR
EFFECTIVENESS OF IMPROVEMENTS

Location _____

Analysis Area (Intersection/Section & Length) _____ Length _____

Type of Improvement _____

Effective Date of Improvement _____

Traffic

1970	_____	ADT/Peak Hour	_____	_____	Length
19	_____	ADT/Peak Hour	_____	_____	
Change	_____	=	_____ %		

Capacity

1970	_____	VPH	I.S.=	_____
19	_____	VPH	I.S.=	_____

Accidents

1970	_____	Rate/Number	_____
19	_____	Rate/Number	_____
Change	_____	=	_____ %

Annual Savings thru Change \$ _____

Travel Speed

1970	_____	MPH	_____
19	_____	MPH	_____
Change	_____	=	_____ %

Annual Savings thru Change \$ _____

AVERAGE ANNUAL MOTORIST SAVINGS
SINCE IMPLEMENTATION OF IMPROVEMENT \$ _____

REMARKS: _____

EVALUATION FORM

